DOCUMENT RESUME

ED 468 326 EC 309 164

AUTHOR	Hartman, Melissa, Ed.
TITLE	Imagine...Opportunities and Resources for Academically Talented Youth, 2001-2002.
INSTITUTION	Johns Hopkins Univ., Baltimore, MD. Center for Talented Youth.
ISSN	ISSN-1071-605X
PUB DATE	2002-00-00
NOTE	181p.; Published five times per year. Published by the Study of Exceptional Talent (SET). For the 2000-2001 issues, see ED 458 751.
AVAILABLE FROM	Imagine, P.O. Box 19966, Baltimore, MD 21211-0966 (annual subscription, $25; institutions, $30). Tel: 215-826-0707; Fax: 215-788-6887; Web site: http://www.jhu.edu/gifted/imagine.
PUB TYPE	Collected Works - Serials (022)
JOURNAL CIT	Imagine; v9 n1-5 Sep/Oct 2001-May/Jun 2002
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS
DESCRIPTORS	*Astronomy; Careers; College Planning; Day Camp Programs; *Dramatics; Elementary Secondary Education; *Gifted; *Journalism; Physics; *Robotics; *Social Action; Special Programs; Talent; Theater Arts
IDENTIFIERS	*Odyssey of the Mind

ABSTRACT

This collection of 5 issues of Imagine cover the time period from November/December 2001 through May/June 2002. Designed for gifted youth, the issues focus on dramatic arts, physics and astronomy, communications, law and politics, and robotics, and contain the following featured articles: (1) "The Story of a Play" (Gemma Cooper-Novack); (2) "Listening to Shakespeare" (Cam Magee); (3) "Following My Voice: From NYCO to Opera" (Zach Wissner-Gross); (4) "Catching Up with a Rising Star" (Melissa Hartman); (5) "The Art of Technical Theater" (Priscilla Swan); (6) "Stargazing at its Best: Space Science and Astronomy at Kopernik" (Sam Kapcio); (7) "Space Scientist for a Summer" (Bhavna Sengupta); (8) "Physics Boot Camp: The U.S. Physics Team Training Camp" (Ben Schwartz); (9) "Sines and Wonders: The Science of Sound" (Carol Blackburn); (10) "Extreme Space: Studying Black Holes" (Andrew Ptak); (11) "NHSI: Journalism from Dawn to Dusk" (Gavin Myers); (12) "Osmosis and Trial and Error: An Education in Yearbook" (Christina Sanabria); (13) "The Story Behind Sound: High School Radio" (Paul Campbell); (14) "Almost Famous: Getting a Start with Fox 61 Student News" (Stefani and Amy Lang); (15) "Playing Favorites: An Exploration of Bias in the Media" (Aaron Back); (16) "Yes! You Can Change the World" (David Lau); (17) "A Member of the Board" (Elizabeth Hart); (18) "Hearts and Mines: Joining the Fight against Landmines" (Auguste Dutcher); (19) "Cultivating a World View: Model United Nations" (Emiliano Martin De Luca); (20) "Adventures in Creativity: Odyssey of the Mind" (Luke Murphy); (21) "Botball: LEGOs in Motion" (Monica Garner); (22) "Walking on Ice: A Robot for Alaska" (Hanna and Heather Craig); (23) "My Journey in Robotics" (Eser Chamoglu); (24) "FIRST Days: A Season in Robotics" (Ameya Agaskar); and (25) "Adventures in Robotics" (Hans Anderson). Each issue explores topic-related career options and college planning considerations. (CR)

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Imagine...Opportunities and Resources for Academically Talented Youth, 2001-2002

Melissa Hartman, Editor

Imagine v9 n1-5 Sep/Oct 2001-May/Jun 2002

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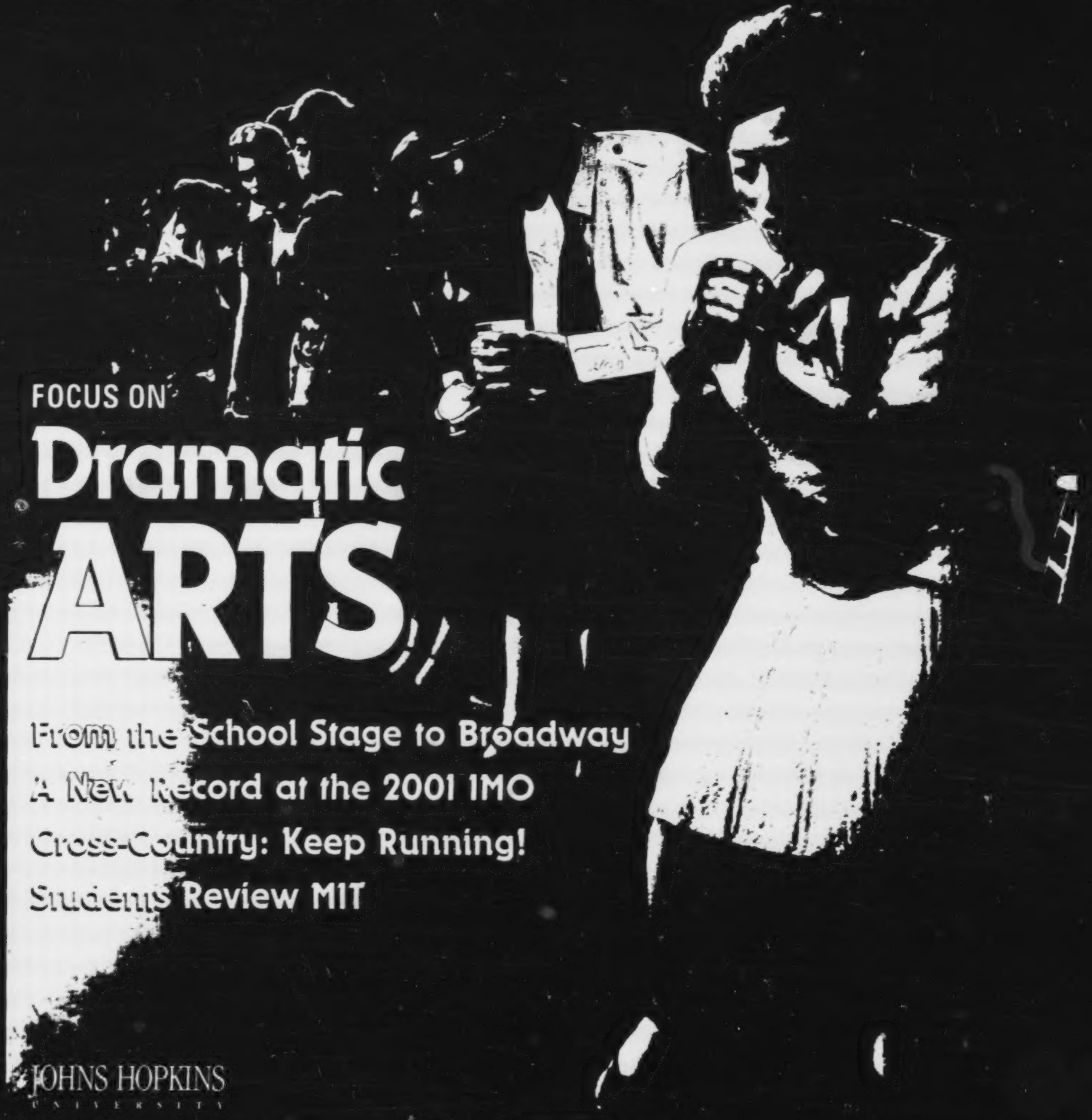

FOCUS ON

Dramatic ARTS

From the School Stage to Broadway

A New Record at the 2001 IMO

Cross-Country: Keep Running!

Students Review MIT

JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

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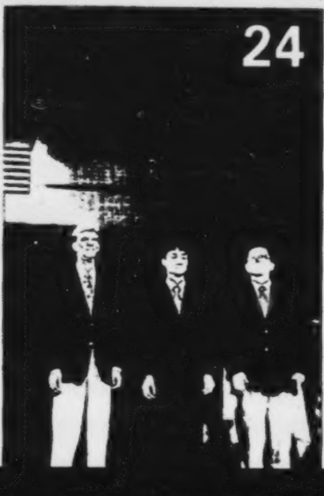

Imagine...
Opportunities and Resources for Academically Talented Youth*

ISSN 1071-605X Volume 9 • Number 1
September/October 2001
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JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

Published five times a year—September/October, November/December, January/February, March/April, and May/June.

Periodicals Postage paid at Baltimore, MD.
and additional mailing offices.

POSTMASTER: Send address changes to *Imagine*,
P.O. Box 3073, Langhorne, PA 19047.

Imagine is published by the Study of Exceptional Talent (SET) at The Johns Hopkins University Center for Talented Youth.

Editor	**Melissa Hartman**
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Annual subscription: $25.00
Institutions: $30.00

Address subscription inquiries to:
Imagine
P.O. Box 3073, Langhorne, PA 19047
(215) 826-0707 • fax: (215) 788-6887
or order online at www.jhu.edu/gifted/imagine

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ON THE COVER: Students from Interlochen Arts Camp perform "Coffee Break" in *How to Succeed in Business Without Really Trying*. Photo courtesy of Interlochen Center for the Arts.

Visit our Web site for this issue's links
www.jhu.edu/gifted/imagine

Photo courtesy of Interlochen Center for the Arts.

Stage Lure

Imagine yourself in a theater. The room is dark except for a bright circle in the center of the stage. You can almost hear the audience breathe, and your own heart races with anticipation.

Now, where do you see yourself? Are you standing in the spotlight—or sitting in the audience? Are you backstage, waiting for your cue to dim the light? Or are you the writer, waiting on the edge of your seat to see your play performed for the first time? In the world of drama, you could play any of these parts.

Drama is a unique genre that allows the most introverted and extroverted among us to have equally rewarding experiences. If you love the idea of being on stage, living the lines from Stoppard or Shakespeare, you might audition for your school's productions and find fulfillment in the spotlight. If you're intrigued by theater but don't want to act, your artistic skills might help create the set, or you might learn technical skills in lighting or sound as part of the stage crew. On stage or backstage, you can share in the satisfaction of a well-produced play.

And drama offers rewards even beyond staged productions. As literature, drama invites us to construct in our minds the worlds and people and events presented in a script. Reading plays, even silently, allows us to hear a range of human voices, to understand what it means to *be* human by experiencing what characters like us—or wildly different from us—say and do. Even when the production takes place only in the mind's eye, a good play can move us in a way that no other literature does.

In this issue of *Imagine*, we explore the world of drama from diverse perspectives. You'll learn what goes into a play long before it reaches the stage from both a young playwright and a professional dramaturg. You'll also discover the thrill of being on stage—both a Broadway stage and the stage of a high school opera company. And to learn what goes on backstage, you'll hear from a theater technician who's done everything from sewing costumes to working as stage manager in her high school's productions.

Then, if you're ready to get involved, you'll find our valuable listing of resources and opportunities to show you how. Whether it's as reader, writer, actor, technician, or audience member, we hope this issue will lead you to a play.

CORRECTION

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In last issue's *The Coach's Corner*, an error occurred in the following sentence: "Thus the sum of the coefficients is equal to $p(1) = p(\cos 90^\circ) = \cos(13 \cdot 90^\circ) = \cos(90 + 12 \cdot 90)^\circ = \cos 90^\circ = 1$." The last part of the sentence should have read "$\cos 90^\circ = 0$."

The Story o

by Gemma Cooper-Novack

2000 Young Playwrights Caroline Noble Whitbeck, Adam Feldman, Sherry Ou-Yang, and Gemma Cooper-Novak

I was raised in the theater. When I was a baby, my mother, then a casting director at a major Off-Broadway theater in New York City, would bring me to work with her every day. I saw plays constantly as a child. When I was six years old, my mother explained to me the backstage structure of the theater, how each person contributed to the plays I saw. When she explained the job of the director, I said, "So the director is the one who makes up the story, right?"

"No," she answered. "That's the playwright."

I knew immediately that I wanted to be the playwright, that I wanted to be the one who made up the story. I started writing a play the next week.

Becoming a Young Playwright

When I was in third grade, I showed one of my plays to my teacher at Saint Ann's School in New York. She spoke to the middle- and high-school playwriting teacher, Nancy Fales Garrett, who recommended that I submit it to Young Playwrights Inc.'s National Playwriting Competition, a contest for writers age 18 or younger.

My play, *Keisha's Revenge*, didn't win or even make it to the top ten. But it did place in the top 25, and I received a letter encouraging me to continue submitting. Every year for the next seven years, I did so.

To the School Stage and Beyond

In seventh and eighth grades, I took playwriting classes with Nancy Fales Garrett, the teacher whose advice I had taken so many years ago. In ninth grade, I took her high-school playwriting class, which lasted the full year and concluded with a festival of full productions presented in the school theater. For that class, I wrote a scene between Nina, a 16-year-old girl, and Brian, her older brother's best friend. It took place on Nina's back porch during a memorial service. As I figured out who had died (Nina's older brother) and wrote more about Nina's family, I realized that this was the play I wanted to write for my first high school playwriting festival. With Nancy's guidance, it became the one-act play *I'm Coming In Soon*. I was thrilled to see it performed—and even more thrilled when it placed in the top ten in the Young Playwrights competition two years later. This allowed me to participate in the Young Playwrights Writers Conference that culminated in a series of staged readings.

When I graduated from St. Ann's in June 2000, I thought my Young Playwrights experience was behind me. However, at the beginning of July, the artistic director of Young Playwrights Inc. called to tell me that *I'm Coming In Soon* had been selected to be produced Off-Broadway in the Young Playwrights Festival. I could hardly believe it: this had been my goal since I was eight years old, and now it was about to be realized.

A Professional Production

About a week before the auditions, I met the woman who would be directing my play, Lynn M. Thomson, and the dramaturg, Emily Morse. I had directed my own plays in high school, but I had never seen anyone else direct my work, nor had I ever worked with a dramaturg, whose jobs include helping the playwright revise to make the play stronger and doing research for the production. For my play, Emily found texts on grief and its effect on the family.

It was exciting to hear Lynn's and Emily's perspectives on my play. The playwright Tom Stoppard once said, "Text of a play is an opportunity rather than an end." I could see that my play was an opportunity, and that with these two women working on it, it could become a more interesting and important end than I had imagined.

At the auditions, I sat behind the table with Lynn and the casting director. It was fascinating to see how different actors had such diverse interpretations of the same scene. For example, one actor, auditioning for Nina, felt Nina's crush on Brian very deeply in Nina's most dramatic scene, which hardly mentions that crush. It made the scene much more humorous than I had imagined it, and we ended up choosing this actor, Erika Thomas, to play the role. I realized that I didn't want to cast actors who played the scenes exactly as I had written them. It was much more interesting to watch those whose ideas gave new texture to my words.

During the five-week rehearsal process, "final draft" became an oxymoron.

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a Play

I made constant alterations to the play. For example, Martin LaPlatney and Susan Pellegrino, the actors who played the parents, believed they would react differently than I had written in a fight with one another. Although I didn't change that scene, their opinions about the characters stayed in my mind when I later wrote a scene between Nina and her father, and when I revised the scene between Nina and her mother. Sometimes I would cut a few lines, either because I'd discover I didn't like them or because the play needed to be shorter. I continued to make changes even after it was performed.

Opening Night

On opening night, I was extremely anxious—Lynn and one of the actors had had a disagreement three days before, and generally the tone of our dress rehearsals had been tense. I knew from my past theater experiences that this often happens before a play opens, but I was still nervous. Added to all this, my play was last in the running order.

Nervous as I was, I loved watching the other three plays. Like mine, they were not the exact same plays that had originally been submitted to the competition. They were more than they had been; the ideas of the directors, actors, and designers had merged with ours. The intermission passed, and as the audience applauded at the end of the third play, Caroline Whitbeck, one of the other playwrights, squeezed my hand—*I'm Coming In Soon* was about to begin.

I noticed right away that the porch swing, one of the most important set pieces, seemed unsteady. Caroline and I sat with our fingers crossed, hoping that Martin and Erika would not come tumbling out of the swing as soon as they sat down.

Fortunately, they didn't, and I was watching a professional production of my play, the play I had shared with my playwriting class in ninth grade, the play I had shared with a tiny audience as a staged reading during the Writers Conference. The weeks of rehearsal had come together, for me and for us all. The applause bounced off the walls of the small theater and filled the room. ■

Gemma Cooper-Novack is a second-year student at the University of Chicago, considering a concentration in linguistics. She is a puppeteer and a writer; her work has appeared in *Hanging Loose, ByLine,* and *Scope*. She plans to continue writing for the rest of her life.

Young Playwrights Inc.

In 1981, Stephen Sondheim founded Young Playwrights Inc. (YPI) to identify talented young playwrights, to expose young people to theater, and to improve literacy and encourage self-expression by making playwriting part of the basic curriculum. Twenty years later, YPI offers a range of programs including playwriting workshops and staff development across the country.

The Young Playwrights Festival National Competition is for writers age 18 and younger. Style, subject, and length are up to the author, but no adaptations, screenplays, or musicals are considered. Finalists are invited to attend the Young Playwrights Writers Conference, where they work on their plays with theater professionals. Four plays will be produced Off-Broadway as part of the Young Playwrights Festival. Entry deadline: December 1.

For more information:

Young Playwrights Inc., 321 West 44th Street,
Suite 906, New York, NY 10036; (212) 307-1140;
Writeaplay@aol.com; www.youngplaywrights.org

For additional playwriting competitions, see page 16.

Todd Lawson (Brian) and Erika Thomas (Nina) in I'm Coming In Soon.

Photographer: Gerry Goodstein. Photo courtesy of Young Playwrights Inc.

by Cam Magee

When I was 15 years old, my dad took me to see *Richard II* at the Old Globe Theatre in San Diego. I remember the speech, "let us sit upon the ground / And tell sad stories of the death of kings," spoken by this one man on stage. Everyone was so fixed on him, listening. I had never experienced the energy of listening to that extent. The power of that moment has always stuck with me.

Around the same time, I had a Shakespeare class in which we watched a lot of films and read Shakespeare out loud. Those words were a safe place to put all the huge emotions I was feeling at the time. I could be angry and not very nice, or I could be tragic and die, or I could practice flirting. I could try on emotions, like clothes, and feel very safe. A Shakespeare play had everything I liked about acting: there was a stage; there was make-believe and dressing-up; there were big emotions; and what was being said, the words, seemed to be important to people.

After high school, I went to the Catholic University of America in Washington, D.C., and earned my degree in theater. When I graduated, I found work at the Folger Theatre, which was part of the Folger Shakespeare Library. In the years since then, I have acted in several Shakespeare plays. I have brought other people into that moment of listening I felt for the first time as a teenager. Now, as both an actor and dramaturg, a lot of my work is to help people hear the plays in a meaningful way.

Mastering the Text

One important thing I discovered in college and as an actor is that no Shakespearean play is performed exactly as it was printed in the Folio. Over the years, I became interested in how the scripts must be adapted, which is one of the roles of a dramaturg. A dramaturg does research for the company and makes sure that the story is clear. For example, there's a line in *Macbeth*, "By Sinel's death I know I am thane of Glamis," but no one knows that Sinel is Macbeth's father. A dramaturg would tinker with that and say something like, "by my father's death I know I am thane of Glamis."

Dramaturgs also work with the director on cutting the text: deciding which lines are and are not necessary to a particular production of the play. Most of Shakespeare's plays are too long for contemporary audiences, and what audiences wanted to see in Elizabethan times is not what we want to see today. Our culture is more interested in conversations between people than in whether or not Shakespeare has his history right according to *Hollingshed's Chronicles*. And some of Shakespeare's jokes just aren't funny to modern audiences. A dramaturg would cut the play with these things in mind.

As a dramaturg, I have learned to think of Shakespeare in very practical terms. In writing the plays, Shakespeare made a lot of decisions that were specific to his theater company. For example, a character might appear briefly in an early scene and then not be seen again for a couple of acts. It's not that Shakespeare orchestrated the timing in his head; it's not even a decision that was crucial to the plot. More likely, that actor was also playing another role. Sometimes he added extraneous elements to the play, like the sudden appearance of Decretas in *Antony and Cleopatra*, just to keep the nobility in the audience happy. Keeping in mind how Shakespeare wrote the plays helps me make decisions specific to our own productions.

One thing I particularly enjoy in my work as a dramaturg is finding more roles for women. The reason we have some really wonderful women's roles already existing in Shakespeare is that there were some wonderful boy actors in his company. If a talented boy actor hadn't been in that company, Juliet might not have been written.

Today, the roles once played by boys are played by women, but that still leaves only about four women's roles in each play. Now, there are more female actors than there are male actors, so it makes sense to put more women on stage. At the Washington Shakespeare Company, we did an all-female

What does it take to bring Shakespeare to the stage in 2001? Actor and dramaturg Cam Magee talks about her work with the Bard and how she helps modern audiences enjoy his plays.

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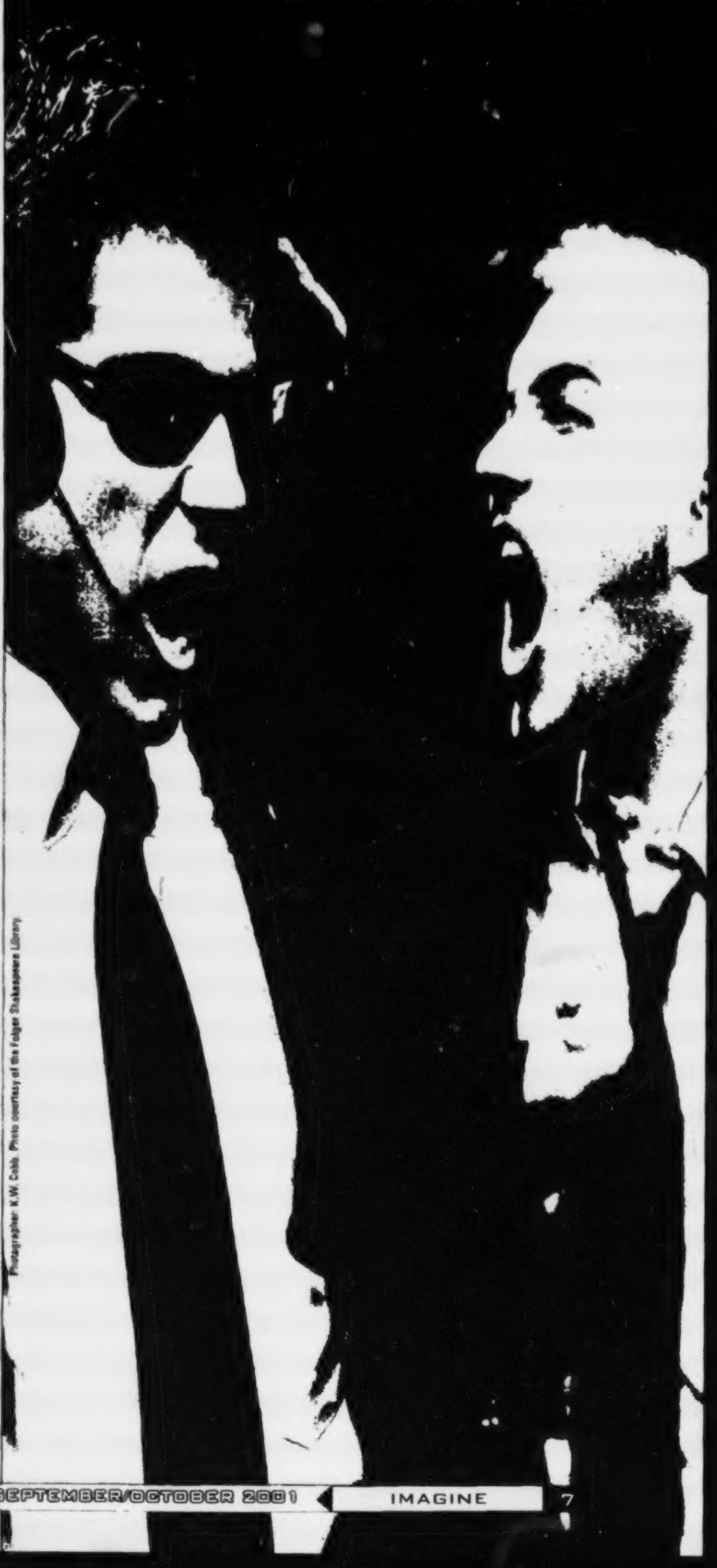

John Worley as Romeo and Christopher Borg as Benvolio in the Folger Theatre's 1997 production of Romeo and Juliet, which Cam and director Joe Banno set in a contemporary Catholic school.

Photographer: K.W. Cobb. Photo courtesy of the Folger Shakespeare Library.

production of *The Taming of the Shrew.* Traditionally there are only three female roles: Kate, Bianca, and the Widow. It was a very good production, and not just for the novelty of an all-woman cast. It woke up some of the language to have it spoken in a woman's voice. Now, instead of just saying, "what a beautiful speech," people who already knew the play could hear it in a different way and get new meaning from it. At the very least, it gave people a new way to talk about the play.

Cymbeline: A Dramaturg's Dream

My favorite play to dramaturg was *Cymbeline. Cymbeline* is basically a love story, but it has so much Roman and English history in it that the love story gets obscured. We cut a lot of that to make the story clearer. We also cut the big battle scenes because we had resources for only 13 or 14 actors. And because no one knows *Cymbeline* very well, I felt totally free to work with the text.

The director, Joe Banno, decided to set the play in Little Italy in New York and in Milford-Haven in Connecticut. Instead of being King of Britain, Cymbeline was a CEO, and we made the Italians mafia. But the best thing we did was to put characters' dreams on stage so the audience could see what was going on in their minds.

continued on page 8

In the Folger Theatre's 1999 production of Hamlet, Cam and director Joe Banno divided the role of Hamlet into four parts. Cam Magee, Steve Carpenter, Holly Twyford (seated), and Kate Norris played the four Hamlets.

Photographer: K.W. Cobb. Photo courtesy of the Folger Shakespeare Library

In the play, Imogen and Posthumus are married without her father's permission, so Posthumus is sent away to Italy. There, he meets Iachimo, and eventually a wager is made that Iachimo can seduce Imogen. Posthumus is confident that Imogen is faithful and so enters into the bet. It turns out that Imogen is exactly who Posthumus thinks she is, but Iachimo cheats: he sneaks into Imogen's bedroom and takes her bracelet while she's asleep. He then shows Posthumus the bracelet as proof that he seduced Imogen. Immediately, Posthumus renounces her and vows to have her killed.

But you don't see what's going on in his mind; you don't know why he makes this turn so quickly. After all, the last time he appeared on stage, he was completely certain of her fidelity. So during this scene we had Imogen on stage in her nightgown, acting out what Iachimo was saying. You could see what was going on in Posthumus's mind. When he found out that he was wrong, we had her walk by in her wedding dress so you could see that her image was restored in Posthumus's mind. This visual representation of his thoughts made his actions much easier to understand.

Modern Shakespeare

A lot of the work I did on *Cymbeline* was related to updating it, and that is what I really love about Shakespeare: there is something in Shakespeare that transcends history. A production can be Elizabethan, or set in Edwardian times, or set in the 1940s or '50s. What he says about human nature applies in all historical contexts.

I like to update Shakespeare. I like to bring him right to 2001. When people see an Elizabethan production of Shakespeare, it takes their ears about ten minutes to adjust to the language. When they see a contemporary version, when they actually recognize the situation—like a business meeting—and see people dressed like them, the language doesn't seem as foreign, and they start hearing the play immediately. They can see how the story applies to their own lives, and it becomes meaningful to them.

I've had a long career of studying and acting Shakespeare. But you don't need a career like mine to love his plays. There is something in the plays for every one of us. And not only does Shakespeare have a lot to say about every situation you might find yourself in, but there's also just the sheer pleasure of the language. So go to a play and listen. Listen. The words are sure to speak to you. ■

Cam Magee is a founding member of the Folger Shakespeare Library's educational acting troupe, Bill's Buddies. Her acting and dramaturging credits include productions at the Folger Theatre, Washington Shakespeare Company, The Washington Stage Guild, and several others. This fall she will co-direct *Antony and Cleopatra* at the Washington Shakespeare Company and will work with director Joe Banno on a production of *Macbeth* at the Folger.

The Folger Shakespeare Library

In 1885, Henry Clay Folger bought a facsimile of Shakespeare's First Folio. That $1.25 purchase was the start of something big: The Folger Shakespeare Library, which now contains about 256,000 volumes. The Shakespeare Collection includes 229 Quarto editions of the plays and poems, 79 copies of the First Folio, 118 copies of the Second, Third, and Fourth Folios, and about 7,000 other editions of Shakespeare's works. Shakespeare scholars from around the world come to the Folger to consult these texts.

But the Folger is much more than books. The Folger stages some of Shakespeare's plays every year and also hosts the Secondary Shakespeare Festival, where students from more than 50 D.C.-area schools perform Shakespeare on the stage of the Folger's Elizabethan Theatre. Bill's Buddies, the educational acting troupe, brings the Bard to students in grades 3 through 12. The Folger also hosts poetry readings, the PEN/Faulkner readings, early music concerts, and many special events for the public. For more information: Folger Shakespeare Library, 201 East Capitol Street SE, Washington, DC 20003; (202) 544-7077; www.folger.edu

Shakespeare on the Web

Countless Web sites offer valuable information about Shakespeare and his works. These excellent pages will lead you to many of them.

Active Shakespeare

http://exp.psychologie.uni-kassel.de/cgi-bin/quiz.pl

Start with the sonnet quiz, but be sure to click on "SHAX.NET" to get to lots of other fun, interactive Shakespeare activities including Drama Trivia and Shakespeare Hangman.

The Complete Works of William Shakespeare

http://tech-two.mit.edu/Shakespeare/works.html

This site includes the full text of the plays; the poetry will be available soon.

Mr. William Shakespeare and the Internet

http://shakespeare.palomar.edu/

If you're doing a research project on Shakespeare, this is the place to start. Includes criticism, timelines, and even links to Shakespearean search engines. See "Other" Sites for some less scholarly Shakespearean links, and see Festivals and Theater Companies for Shakespearean events near you.

Surfing with the Bard

www.ulen.com/shakespeare/

Read the plays, discuss them, even submit your reviews of plays and film adaptations on this fun site.

Zach Wissner-Gross performing in Turn of the Screw. *Below from left: Zach appears in* The Village*; Zach and Julianne Bilker in* The Marriage of Figaro *at South High School; on the playbill for the New York City Opera performance of* Turn of the Screw*; with Lauren Flanigan and Robin Leigh Massie in* Turn of the Screw.

Following My Voice

From NYCO to High School Opera

by Zach Wissner-Gross

When I was seven years old, the gallant Toreador from the opera *Carmen* strutted into the backstage lounge at the New York City Opera in his bright red, gold-braided uniform to grab a quick snack. I had a revelation, for I suddenly realized what I wanted to be when I grew up. I whispered to my mother that I wanted to be a Toreador—not the kind that fights bulls, but the kind that sings opera.

Throughout elementary school and part of middle school, I sang professionally with the New York City Opera (NYCO) and appeared with other opera companies, starting as a children's chorus member in operas like *Carmen* and *La Boheme*, and eventually starring in *Turn of the Screw* and *Amahl and the Night Visitors* at Lincoln Center. NYCO provided free voice lessons, as well as on-the-job acting training. I referred to professional singing as my "childhood career," which ended abruptly after my last performance of

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STAGEBILL
CITY OPERA

Opera Lessons

You don't need to make opera a life-long career to reap the benefits. Many of the lessons of performing may be applied to all pursuits.

My career plans have changed since I first saw that Toreador backstage: I am now pursuing science research as a career goal. But the lessons I learned by performing with the New York City Opera and other companies have contributed enormously to my success in my new interests.

Opera gave me confidence. When I sang the starring role of Amahl in *Amahl and the Night Visitors* at Lincoln Center in New York, I performed before 9,000 people in a single day. That was far more daunting than presenting my research at science competitions before a handful of judges.

Opera taught me to budget my time well and to maintain focus. Opera companies operate on tight rehearsal schedules to coordinate among the vast numbers of artists in each production. Whenever I was granted a solo, I was given deadlines in which to learn my music and staging. The discipline of preparation and rehearsal carried over to my study habits, teaching me how to allow enough time to prepare for exams and long-term projects.

Opera helped me develop an assortment of learning strategies. In studying the music to Joel Mandelbaum's modern opera, *The Village*, at age 10, I played audio tapes repeatedly until the music was firmly in my head. To learn lyrics in unfamiliar languages, I have relied heavily on mnemonic devices. For *Turn of the Screw* at NYCO, in which I was the only child in the cast, I sometimes resorted to simple rote memorization. All of these techniques have come in handy in studying foreign language, history, and biology.

Opera taught me to handle success and rejection. At a final callback audition for the Broadway show *Beauty and the Beast*, I recognized a boy who had been very successful in other Broadway shows. When another parent asked his mother what it's like to have a son who is always successful, the boy's mother confided, "Nobody has success all the time. My son receives four rejections for every success. The public only sees the success." She explained that the trick to success was being able to either ignore rejections or use them to motivate you to work even harder. Of course you hope not to have many rejections in life. But when you go for many auditions, you learn that brains, talent, and hard work don't guarantee success. Sometimes, no matter how deserving you feel, other factors, such as height, hair color, body proportion, or voice, interfere. Learning not to get discouraged when others don't fully appreciate your presentation or insight frees you to take more risks.

Opera taught me to do what I love. Probably the greatest lesson I learned by performing with high school students is to enjoy opera for the sake of opera, and to appreciate the fun of making music.

— ***Zach Wissner-Gross***

Turn of the Screw, when my voice began to change at the age of 11.

New Stages, New Challenges

Determined to continue performing, I auditioned for school shows and got a mostly dancing/acting role, Fyedka, in *Fiddler on the Roof* at my middle school. Two years later, as my voice began to settle, I performed the lead role, Joe Hardy, in the Great Neck South Middle School production of *Damn Yankees*.

The next year I entered high school, and my new music teacher, Dr. Pamela Levy, announced that our school's opera group would soon begin auditions for *Carmen*. Great Neck South High School is one of the few public high schools in the country with an opera program. Operas have been presented for 32 years at South, and performing with the Great Neck South Opera Theatre has become a family tradition. My mother and my aunt were two of the program's early cast members. My older brother, Alex, also sang with the group in *Gianni Schicchi* and *Candide*.

A Musical Community

Maybe because my high school is located so close to New York City, an international center of performing arts, many Great Neck families approach music seriously. (Famous performers who have resided in Great Neck include opera singer Richard Tucker, Broadway singer Fanny Bryce, folk singer Oscar Brand, comedians W.C. Fields, Groucho Marx, and Andy Kaufman, and composer George M. Cohan.) At the railroad station on Saturday mornings, it is not uncommon to see students commuting to prestigious music conservatories including Juilliard and Manhattan School of Music. As a result, our school orchestra sounds quite professional, and the opera program benefits from their accompaniment.

It is no surprise that the students who love playing their instruments eagerly join the opera's orchestra. However, what may seem surprising is that our opera program is able to attract a fairly large cast of high school singers and actors. About 100 students participated in *Carmen*, which included a children's chorus drawn from younger grades in our district. In addition to the singers and orchestra, the program includes a stage crew and separate TV crew, who tape and televise the operas for our school district TV.

Because there is such interest in opera and singing in our school, there is, naturally, a competitive spirit when it comes to auditions. When I auditioned for professional Broadway shows (e.g., *Tommy*, *Beauty and the Beast*, and *Les Misérables*), I found that my main competition was often a core group of fewer than ten professional performers. Similarly, in the school operas, there is a core group of students who compete for the principal (lead) roles. However, in the professional theater, the elite group of performers were all vying for a single part, whereas in school many students will get lead roles, since all roles are performed by students. This creates a more relaxed atmosphere.

Making it Work

Although the auditions are less stressful in high school, productions are far more rigorous because the time frame is severely limited. The performers are all full-time students, whose school and homework come first. During the opera season, rehearsals generally take place after school, but Dr. Levy sometimes squeezes in practice during study halls, lunch periods, in the evening, or even after after-school activities. When I was at NYCO, we had the luxury of rehearsing all day for weeks at a time, since the adults were devoted full-time to opera and the children were still young enough to have relatively little homework.

Our school opera program also has a budget that is minuscule compared to NYCO's. So we don't have the luxury of personal dressing rooms, full-time costume coordinators, professional hair/makeup artists, full-time set designers, or weeks of performances. Each production gets two full performances (plus some in-school "teasers"). However, through numerous fundraisers, hard work by faculty, and help from parents and students, our company is able to assemble quality scenery, costumes, and props.

The Call of the Stage

It is difficult to say exactly why I returned to opera after my retirement from the New York City Opera. Perhaps I did it because I enjoyed performing with fellow classmates. But more likely, I returned because of my love of the opera *Carmen*. It was the first opera I had ever participated in, and it was also my first time on stage in front of thousands of people. But I didn't get the part of the Toreador. I was a freshman, and that part went to a senior. I got the other male lead, though, the tragic Don Jose, which was even more challenging for me.

Last year I auditioned once again for the school opera, Mozart's *The Marriage of Figaro*, in which I sang the comic role of the Count Almaviva. This year I look forward to my third high school opera production, Mozart's *The Magic Flute*, in which I performed the part of the First Spirit as a boy soprano at NYCO. As the audition date approaches, my voice is still getting lower. Dare I try for the very deep bass part of Sarastro? ■

Zach Wissner-Gross, 16, who performed professionally for five years, also enjoys the spotlight as captain of the Great Neck South High School math team, a nationally ranked fencer, and winner of many science competitions. This past summer he worked with epithelial stem cells at the National Institutes of Health.

Curious about Opera?

Check out these books and Web sites:

***Opera 101: A Complete Guide to Learning and Loving Opera* by Fred Plotkin (Hyperion, 1994).** Written by a performance manager for the Metropolitan Opera, this step-by-step listener's guide includes reviews of 11 famous operas.

***Opera For Dummies* by David Pogue and Scott Speck (Hungry Minds, Inc., 1997).** The same fun and friendly format as the other For Dummies books—plus a CD with excerpts from some of the most famous operas.

***The Penguin Opera Guide, Abridged Version* by Amanda Holden (ed.) et al (Penguin USA, 1999).** This extensive and comprehensive guide includes profiles of more than 150 composers and entries on more than 450 operas.

Grove Music
www.grovemusic.com/index.html
A valuable reference for all types of music, this site now also includes the New Grove Dictionary of Opera.

Michael's Opera Links
www.stairway.bc.ca/bjorling/opralink.htm
Links and links and links to all things opera.

New York City Opera Learning Center
www.nycopera.com/learn/resource/index.cfm
Synopses, biographies, and a glossary provide background information for opera novices.

Opera World
www.operaworld.com
Check out the Online Opera Learning Center, or go to the Broadcast Booth to find out where you can hear opera on TV, the radio, or the Internet. A comprehensive resource.

Catching up With a Rising Star

Spotlight on Actress Rita Glynn

by Melissa Hartman

Rita Glynn is like many other ten-year-olds. She loves dolls, swimming, drawing, and playing with her friends. What sets her apart is a unique talent, one that her mother noticed when Rita was just three years old.

"Even as a baby, Rita was always very tuned in to music. But when she got to be around three, she sang a lot and danced a lot—and was really good for a three-year-old," says Thelma DeCarlo-Glynn, Rita's mother.

It just so happened that Rita's swimming teacher was also a voice teacher, so Rita began taking voice lessons with her. Like many other kids her age, she also started taking ballet and tap classes. She was happy—and, as her parents came to learn, extraordinarily talented. They realized that this was a gift that they would need to help her pursue as long as it made her happy. No one had any idea how far it would take her.

From Local to National Theater ...

Rita's favorite show had always been *The Sound of Music*. She and her mother remember watching the movie over and over with Rita singing and dancing along to the music. So when her mother saw an ad announcing open auditions for the local theater company's production of *SOM*, she asked Rita if she wanted to give it a try.

Rita auditioned for and got the part of Gretl, the youngest of the von Trapp children. She then went on to act in local companies' productions of *Joseph and the Amazing Technicolor Dreamcoat* and *The Music Man*. She was becoming a better singer and actor with every experience, so her parents decided that it was time to get her an agent.

In the way things that are meant to happen do, her agent, who is based in New York, called with news of auditions for the National Broadway touring production of *The Sound of Music*. It was the show that Rita loved most of all, and she had experience. It was a perfect fit. This time, she would play Marta, the second-youngest of the von Trapp children.

The touring production, which starred Richard Chamberlain as Captain Georg von Trapp, took Rita on the road for six months. Rita's older brother and mother made the tour with her. Her father made trips back and forth between their home in North Carolina and locations across the country. In the course of the 200 performances of the show, Rita saw the country from Palm Beach to Portland, St. Louis to Seattle.

But it wasn't a six-month vacation. Rita joined the tour in January, which meant that Rita and her brother were missing school. The kids in the production were taught by one of two tutors; Rita's school would send the work to her, and the tutor would cover that material with her. Rita's mother tutored her 12-year-old brother. Despite the challenges of travel and performing, Rita kept up with her schoolwork.

Just as important, she continued to grow as an actress. Her next role—not in the touring production of a Broadway play, but on Broadway itself—would continue to challenge her skills.

... to Broadway

The Sound of Music closed in June, and Rita auditioned in July for a role in the Broadway production of *Jane Eyre*, the musical adaptation of Charlotte Bronte's novel. She won the role of a schoolgirl and also understudied the roles of Adele and Young Jane.

She rehearsed all three roles and, in the course of the show's 246 performances, went on stage in all three roles. After playing Adele four times and Young Jane twice, she wasn't sure which was her favorite role. "They were all so much fun. Adele is French and happy and playful, and Young Jane of course is British and serious. They were all different, and all very cool."

But being on stage was just part of the Broadway experience for Rita. *Jane Eyre* was nominated for five Tonys—Best Lighting, Best Book, Best Score, Best Actress and Best Musical—and,

Rita is ready backstage for the opening night gala with balloons from her agent.

although it didn't win any awards, Rita enjoyed going to the ceremony. "It was so much fun, but it was also so hard to wait to see what would happen. I was a little disappointed that we didn't win anything, but Marla [Schaffel, who played Jane] was fine with it. I learned a lot from her that night."

She also got to sing on one of the tracks on the *Jane Eyre* recording. "It is a good recording," she says. Her mother agrees: "We sometimes listen to the CD in the car. When I hear the music, I have the same emotions I had when I saw her on stage. It's hard to believe that it's really my daughter's voice."

A Starring Role

Not every audition ends with a congratulatory phone call from her agent. Rita remembers in particular her audition for *Annie Get Your Gun*, which she didn't know would include dance. "I didn't know that there was going to be dancing, and I didn't have a dance prepared. Eventually they taught us this whole dance routine, then told us all to sit down. They picked the people they wanted and told the rest of us, including me, 'thank you very much.'"

Since then, she's gone to every audition fully prepared. Her most recent audition was for the role of Scout in the Ford Theater's upcoming production of *To Kill a Mockingbird*. For this, she had to come prepared with a monologue of her choice to read in a Southern accent. The director liked her reading, so she was asked to do a reading from the play. After just a few minutes of studying the lines outside with her mom, she was reading them for the director. She learned that day that she was getting a callback for the next level of auditions.

"I had five callbacks for this show. For the third one, I had to come prepared knowing the whole script. I had an hour-long reading with the director. When he said, 'I'll see you tomorrow,' I was so excited."

The next two callbacks were for readings in front of producers. A few days after the fifth callback, Rita's agent called to say, "Congratulations, Scout!"

This role will be challenging, Rita admits, because it's more dramatic than the roles she has played in musicals. But she looks forward to it with the same excitement as she took to that first performance of *The Sound of Music*.

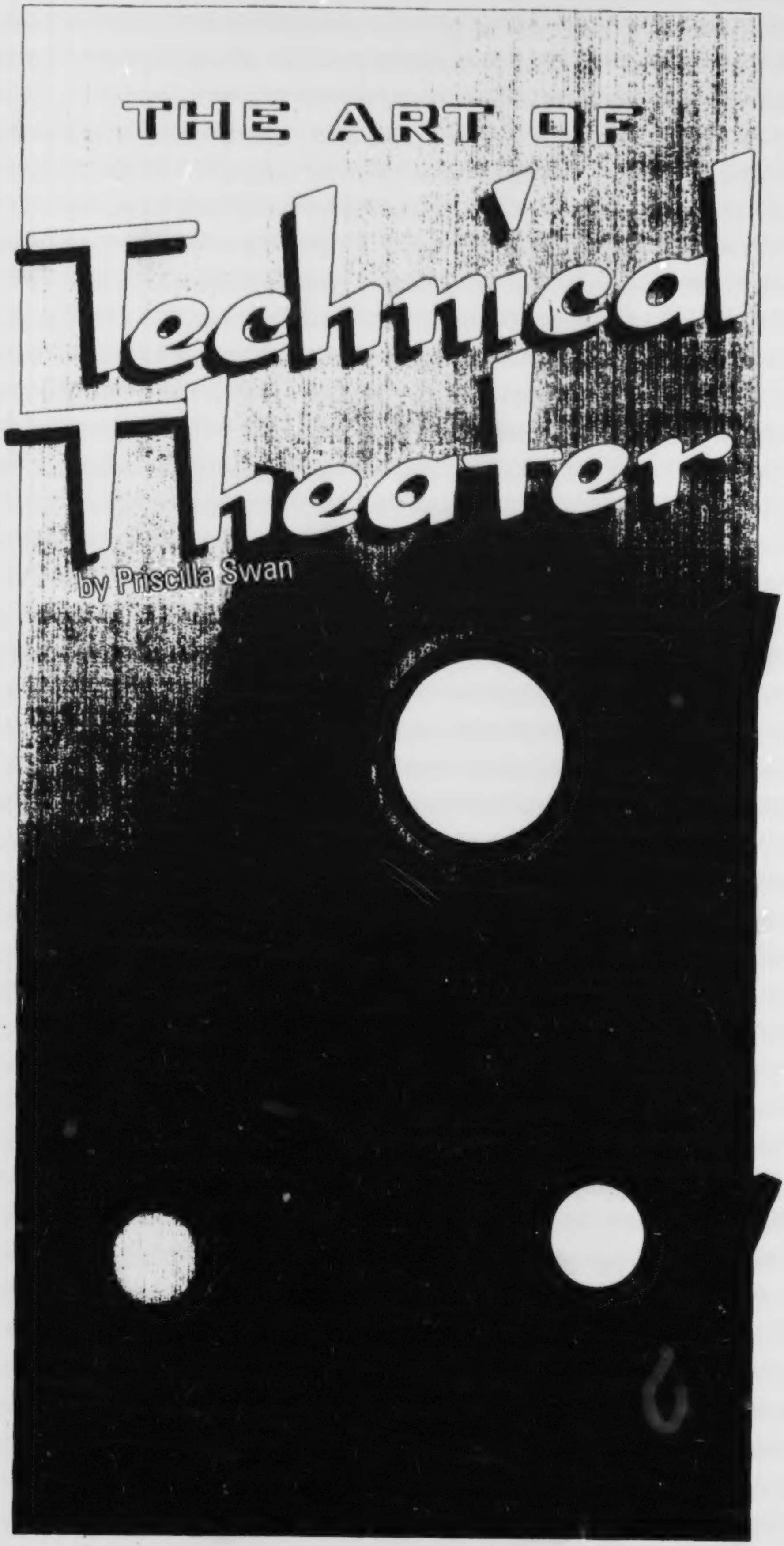
What's beyond this? She doesn't know for sure. Her mother says that she can keep on as long as it makes her happy, but realizes that it's a difficult business. "You don't know if your last show is your last ever. You don't know if you'll ever get cast again. It's totally unpredictable."

And that's fine with Rita. The possibilities are still wide open for her—she doesn't know if she'll be a veterinarian, a teacher, a ballerina.

"I want to be able to do this my whole life," she says, "but I also want a life outside of theater." ■

JANE EYRE
THE MUSICAL

PICTURED FROM TOP: Rita poses in front of the Brooks Atkinson theater; Rita and company in their dressing room with their "Kid wrangler"; Rita in costume for the part of Young Jane, one of two parts that she understudied; Rita and cast members outside Radio City Music Hall before the Tony Awards.



THE ART OF Technical Theater

by Priscilla Swan

When I was in middle school, my older brother was always involved with the productions of his high school's musicals. I used to sit in the audience, searching the stage for him, but I never saw him. I didn't know what was involved in staging these productions; I never wondered who created the beautiful sets or who did the lighting. I didn't realize that although I didn't see my brother, his work was all over the stage.

Initiation of a Techie

In my freshman year, I began to understand the importance of my brother's performance backstage. Older friends encouraged me to join them at evening work calls for the annual spring musical. During work calls, we would paint scenery, collect props, sew costumes, build set pieces, work on lighting, and whatever else the show required.

My lesson in technical theater began with the musical *Once On This Island*. On my very first work call I learned how to use an electric screwdriver; by the final performance I had helped build the set and had painted scenery. I remember the excitement I felt when asked to run stage crew, which meant working backstage during the actual performances. *Once On This Island* did not require a lot of scene changes, but I was responsible for moving a number of set pieces on and off stage in between scenes. Although I wasn't acting, I knew that my work was necessary to the production.

From Stage Crew to Stage Manager

I enjoyed the work so much that I attended work calls in my sophomore year for several school productions, including the spring musical, *Pippin*. But in my junior year I became much more involved. The spring musical that year was *The Music*

Man, and I worked as the assistant stage manager. I attended every rehearsal, took down the director's notes, kept track of the actors and techies, and helped organize the weekly work schedule.

During performances, the senior stage manager sat backstage with a copy of the script, while I sat in the production booth with another copy. Our scripts contained all our notes on blocking, sound cues, and lighting cues, and we both read through the show as it was performed on stage. When we needed a change in lighting or a sound, like a doorbell or train whistle, the senior stage manager called "go" over a headset, and I gave the cue to the light or soundboard operator. These were the things I had taken for granted when I sat in the audience; now I knew how much work went into bringing together the details of a production.

Immersion in Light

My work as a stage manager only made me want to learn more. In the summer after my junior year, I attended the technical theater program at the Center for Creative Youth (CCY), where for five weeks I explored the more complex and artistic side of technical theater. My classmates and I studied set, light, and sound design and worked hands-on with lighting instruments and sound equipment. We were responsible for the performances put on by students in the theater and musical theater programs, which meant we created sets, worked on lighting design, wrote light and sound cues, and stage managed their productions. Five of our classes were held at the Goodspeed Opera House, where we studied the work of professional technical directors, producers, electricians, and designers.

Until that summer I had little experience with lights, but at CCY I saw my first light plot and got a taste for lighting design. A light plot is like an architect's plan for a house; specific measurements and instruments are noted, as are other important details, like color. The light designer works with the director and set designer to create the director's desired look, or concept, of the play. For example, if a director believes a script is sad and sarcastic, he or she might ask the lighting designer to create a stark, simple design. On the other hand, if a script is humorous, a designer might use many brightly colored lights. A good light design can change a scene dramatically, enhancing the mood of the piece.

I realized at CCY that technical theater is both an art and a science, that if done well it can contribute enormously to a play without distracting from the performance. I brought this knowledge and many technical skills back to my high school to share with the other students.

Backstage Benefits

The technical skills I gained at CCY served me well during my senior year, when I taught other students during work calls, led stage crews, and stage-managed the spring musical, *Oklahoma*. In college, my knowledge of lighting allowed me to gain a work-study job as a shop electrician in the theater department, where I'm responsible for hanging lights for our college productions. During the summer, I work as a teaching assistant for the technical theater program at CCY, helping younger students master the skills I learned here just two years ago.

Working backstage has taught me to enjoy and appreciate a play for more than just its story—I notice the lighting and the set, and I recognize the correlation between the lighting and the mood of a scene. Most important, I have learned to appreciate the performance of everyone involved, from the actors on stage to the techies behind. ■

Priscilla Swan is a sophomore at Smith College, where she plans to major in American Studies. During the year she worked on a number of theater and dance productions at Smith. She enjoys writing short scenes for the student theater group and working as a DJ for the college radio station.

The Center for Creative Youth

Students from across the country come to the campus of Wesleyan University in Connecticut for five weeks of intensive study in creative writing, dance, filmmaking, music, visual arts and photography, or theater and technical theater. Students must be at least 14 years old and in grades 10 through 12. Financial aid available. Application deadline: March 10.

The Center for Creative Youth
Wesleyan University, 350 High
Street, Middletown, CT 06459;
(860) 685-3307;
ccy@wesleyan.edu;
www.crec.org/ccy/

SELECTED PROGRAMS AND RESOURCES

DRAMATIC ARTS

COMPETITIONS

American High School Theatre Festival

High school theater programs are invited to apply after being nominated by a state, regional, or national theater organization or a university theater professor. The best programs are invited to Edinburgh (schools must fund their own trips), where they will perform before an international audience as part of the Edinburgh Fringe Festival. Schools are notified in the spring and attend the festival in August of the following year. *2000 Holiday Drive, Charlottesville, VA 22901; (888) 882-4783; www.ahstf.com*

Arts Recognition and Talent Search (ARTS)

High school seniors submit audio tapes, videotapes, slides, or writing samples with their application packet. Top candidates in each of nine categories— Dance, Music, Voice, Jazz, Theater, Photography, Visual Arts, Film and Video, and Writing—receive an all-expenses-paid trip to ARTS Week in Miami, where they take part in master classes, seminars, and readings. Outstanding applicants earn nominations to the White House Commission on Presidential Scholars in the Arts, consideration for scholarships, and cash awards of up to $3,000. **Deadline:** early October. *National Foundation for Advancement in the Arts, 800 Brickell Avenue, Suite 500, Miami, FL 33131; (305) 377-1140; info@nfaa.org; www.artsawards.com*

Donna Reed Foundation Scholarships

High school seniors submit an application and video- or audio tapes or a CD. Three finalists in each of five divisions—Acting, Musical Theater, Vocal Music, Instrumental Music, and Dance —receive all-expenses-paid trips to the annual Donna Reed Festival and Workshops for the Performing Arts. There, students study with and perform for industry professionals and compete in a live performance for the $4,000 scholarship awarded in each division. All finalists are also awarded lifetime tuition-free scholarships to future Donna Reed Performing Arts Workshop Programs. **Deadline:** early March. *Donna Reed Foundation, 1305 Broadway, Denison, IA 51442; (712) 263-3334; info@donnareed.org; www.donnareed.org*

Scholastic Art and Writing Awards

Students in grades 7–12 may enter their work in any of 16 visual arts and 8 writing categories, including Dramatic Script. National winners go to Washington, D.C., to read or display their work and attend awards ceremonies. Prizes include cash, scholarships, certificates, and publishing opportunities. Contact your regional sponsor for deadline; some are as early as November. *Scholastic Art and Writing Awards, 555 Broadway, New York, NY 10012; 212) 343-6493; www.scholastic.com/artandwriting/*

Thespian Playworks

Members of the International Thespian Society submit scripts for evaluation. Four finalists receive free admission to the International Thespian Festival, where they are assigned a high school director and a dramaturg (usually a professional playwright) and select a cast from the thespians attending the festival for a series of rehearsals and staged readings. **Deadline:** mid-February. *Educational Theater Association, 2343 Auburn Avenue, Cincinnati, OH 45219; (513) 421-3900; www.edta.org/rehearsal_hall/thespian_playworks.asp*

Young Playwrights National Playwriting Competition

See page 5 for details about this competition.

SUMMER PROGRAMS

The following programs are among the best available for aspiring actors, playwrights, and theater technicians—but this listing is still only a small sample of what is available. If you don't see something listed in your area, inquire at local colleges, arts councils and theaters.

American Academy of Dramatic Arts Summer Program

Ages 14 and older, commuter (programs in both New York and California). Six-week session in the dramatic arts including acting, movement, vocal production, and voice and speech. *AADA/East, 120 Madison Avenue, New York, NY 10016; (800) 463-8990 OR AADA Hollywood, 1336 North Brea Avenue, Hollywood, CA 90028; (800) 222-2867; www.aada.org*

Boston University Theatre Institute

Grades 10–12, residential and commuter. Six-week session in theater including acting, audition technique, directing, movement, playwriting, script analysis, Shakespeare performance, singing, and stage combat. *Meg Wright, Assistant Director, Boston University Theatre Institute, 855 Commonwealth Avenue, Room 470, Boston, MA 02215; (617) 353-3390; www.bu.edu/sfa/affiliated/theatreinstitute/theatre_institute.html*

California State Summer School for the Arts Theater Program

Grades 9–12, residential. Four-week collegiate-level acting course covers movement, physical comedy, acrobatics, mask, stage combat, dance, voice, musical theater and physical improvisation. CSSSA also offers sessions in animation, creative writing, dance, music, video and film, and visual art. *California State Summer School for the Arts, P.O. Box 1077, Sacramento, CA 95812-1077; (916) 227-9320; www.csssa.org/D_Theatre1.html*

Carnegie Mellon University Pre-College Programs

Grades 11 and 12, residential and commuter. Six weeks of intensive conservatory training in acting, musical theater, and design and production. Sessions also offered in architecture, graphic or industrial design, music, and visual arts. *Pre-College Admission, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213; (412) 268-2082; www.cmu.edu:80/enrollment/pre-college/*

The Center for Creative Youth

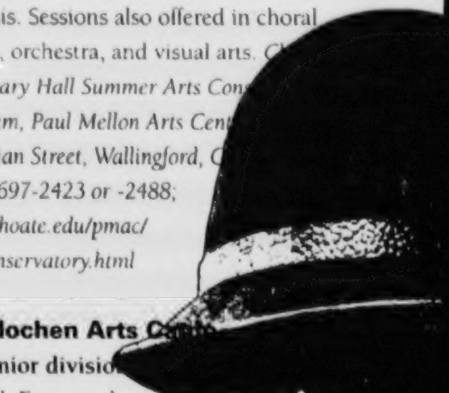
See page 15 for details about this program.

Center for Talented Youth

Grades 7 and up, residential and commuter, three weeks. Qualifying students may take the CTY course The Crafting of Drama or the CAA Drama course, both of which focus on playwriting. CTY also offers courses in topics ranging from archaeology to number theory. *CTY Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277 or (818) 500-9034; www.jhu.edu/gifted/ctysummer*

Choate Rosemary Hall Summer Arts Conservatory Program

Grades 7–12, residential and commuter, five weeks. Theater session covers acting, acting styles, movement, and musical theater. Playwriting session covers scriptwriting, playwriting labs, screenplay development, and film analysis. Sessions also offered in choral music, orchestra, and visual arts. C
Rosemary Hall Summer Arts Con
Program, Paul Mellon Arts Cen
Christian Street, Wallingford, C
(203) 697-2423 or -2488; www.choate.edu/pmac/artsconservatory.html



Interlochen Arts

Junior divisio
dential. Four-week sessio
and production. **Intermediate**
grades 6–9, residential. Four- and eig
week sessions in acting and musical theater. **High school division**: grades
9–12, residential. Eight-week sessi in
musical theater, repertory
theater design and
Interlochen also **offers**
divisions in music, **dan**
ing, and visual art. ***Inter***
the Arts, P.O. Box 199, ***Inter***
49643; (231) 276-7472;
www.interlochen.org

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SELECTED PROGRAMS AND RESOURCES

DRAMATIC ARTS

Marquette University Summer Theatre Academy

Grades 9–12 plus college freshmen. Four-week session offering eight classes: Acting for Stage and TV, Shakespeare, Playwriting, Voice and Movement, Stage Combat, Improvisation, Concepts of Comedy, and Technical Theatre. *Susan Yokofich, Summer Theatre Academy Administrator, Marquette University, College of Communication, Johnston Hall, P.O. Box 1881, Milwaukee, WI 53201-1881; (414) 288-7505; www.marquette.edu/theatre/summeracad/*

National High School Institute

Grades 10–12, residential. Five-week session covers acting, voice and movement, aesthetics of performance, text analysis, and production. NHSI also offers sessions in dance, journalism, leadership, media arts, and music. *NHSI, Northwestern University, 617 Noyes Street, Evanston, IL 60208-4165; (800) 662-NHSI; www.northwestern.edu/nhsi*

New York University Tisch School of the Arts Summer High School Programs

Grades 11 and 12, residential. Four-week sessions in drama, filmmaking, and musical theatre writing. Acting session covers TV/film technique, speech, movement, and tap/jazz dance technique; playwriting session covers theatre songwriting and the principles of playwriting. *New York University, Tisch School of the Arts, Summer High School Programs, 721 Broadway, Room 1247, New York, NY 10003-6807; (212) 998-1811; www.nyu.edu/tisch/summer/highschool.html*

North Carolina School of the Arts Summer Session

Grades 9–12, residential. Five-week session in acting, movement, voice and speech, and special techniques. Sessions also offered in dance, filmmaking, music, and visual arts. *North Carolina School of the Arts, 1533 South Main Street, Winston-Salem, NC 27127; (336) 770-3290; www.ncarts.edu/summer/summer%20session.htm*

Theatreworks

Grades 10–12, residential and commuter. Two-week session covers movement, acting techniques, voice, and scene study. *Theatre Arts Department, 107 Theatre Building, The University of Iowa, Iowa City, IA 52242-1705; (319) 335-2700; denise-matthes@uiowa.edu; www.uiowa.edu/~theatre/theatreworks.htm*

The University of the Arts Pre-College Summer Institute

Grades 10–12, residential and commuter. Four-week drama program covers acting, movement and stage combat; the musical theater program covers voice, dance, and acting. Sessions also offered in fine arts, jazz, and media and communications. *Pre-College Programs, The University of the Arts, 320 South Broad Street, Philadelphia, PA 19102; (215) 717-6430; www.uarts.edu/newhub.html (click on Continuing Studies and then Pre-College Summer Institute)*

BOOKS

ACTING & AUDITIONING

An Acrobat of the Heart: A Physical Approach to Acting by Stephen Wangh (Vintage Books, 2000).

Acting A to Z: The Young Person's Guide to a Stage or Screen Career by Katherine Mayfield (Watson-Guptill Publications, 1998).

Acting: The First Six Lessons by Richard Boleslavski (Routledge, 1987).

An Actor's Handbook: An Alphabetical Arrangement of Concise States on Aspects of Acting by Constantin Stanislavski (Theatre Arts Books, 1987).

Auditioning: An Actor-Friendly Guide by Joanna Merlin (Alfred A. Knopf Inc., 2001).

How to be a Working Actor: The Insider's Guide to Finding Jobs in Theater, Film, and Television by Mari Lyn Henry and Lynne Rogers (Watson-Guptill Publications, 2000).

True and False: Heresy and Common Sense for the Actor by David Mamet (Vintage Books, 1999).

PLAYWRITING

The Art & Craft of Playwriting by Jeffrey Hatcher (Story Press, 2000).

The Dramatist's Toolkit: The Craft of the Working Playwright by Jeffrey Sweet (Heinemann, 1993).

The Playwright's Process: Learning the Craft from Today's Leading Dramatists by Buzz McLaughlin (Back Stage Books, 1997).

Playwriting in Process: Thinking and Working Theatrically by Michael Wright (Heinemann, 1997).

Solving Your Script: Tools and Techniques for the Playwright by Jeffrey Sweet (Heinemann, 2001).

Writing Your First Play by Roger A. Hall (Focal Press, 1998).

TECHNICAL THEATER

The Backstage Handbook: An Illustrated Almanac of Technical Information by Paul Carter (Broadway Press, 1994).

The Stagecraft Handbook by Daniel A. Ionazzi (Betterway Publications, 1996).

Technical Theater for Nontechnical People by Drew Campbell (Allworth Press, 1999).

Theatre Backstage from A to Z by Warren C. Lounsbury and Norman C. Boulanger (University of Washington Press, 2000).

WEB SITES

These sites will lead you almost anywhere you want to go in the world of theater. Link to these and other sites listed in this issue at www.jhu.edu/gifted/imagine

Broadway Online

www.broadwayonline.com

Go to the neon building called "Reference Center" for a comprehensive links page that will lead you to countless theater-related sites, including discussion groups, educational programs, and more.

DramaWest Links Directory

http://members.iinet.net.au/~kimbo2/Dramawest/links.htm

Links to general resources and specialized topics such as the use of computers in theater, and everything in between.

Theater Central

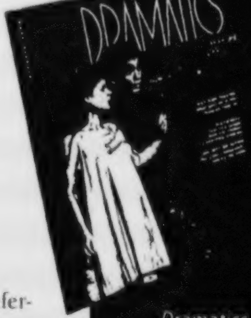
www1.playbill.com/cgi-bin/plb/central?cmd=start

Clicking on "Sites" will take you to a links page with something for everyone, from playwrights to theater fans.

All photos on pages 16–19 courtesy of Interlochen Center for the Arts.

INTERNATIONAL THESPIAN SOCIETY

ITS is an honor society for theater students worldwide. Students join Thespian troupes at their high schools and may attend various theater festivals, including the annual International Thespian Festival. Not all members of ITS are actors; some of the most outstanding members of ITS focus on the technical aspects (stage managing, set design, costuming, sound, lighting) of theater and have never performed for an audience. The only requirement for becoming a Thespian is a love of all aspects of theater, from dance to acting to rigging the lights and everything in between.



ITS also publishes *Dramatics* nine times a year for high school theater students and teachers. Issues include practical advice for students on and behind stage, profiles of theater professionals, new plays, and more. You don't have to be an ITS member to subscribe.

For more information on ITS or *Dramatics*, contact the Educational Theatre Association, 2343 Auburn Avenue, Cincinnati, OH 45219-2819; (513) 421-3900; www.edta.org

LONGIUS, FORTIUS, CITIUS:

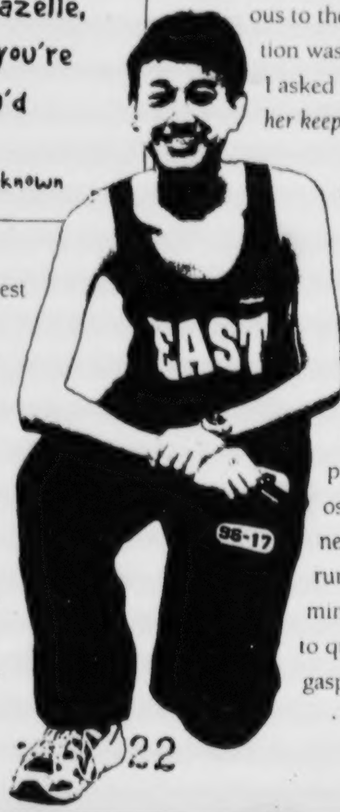
THE REWARDS OF CROSS-COUNTRY RUNNING

> Every morning in Africa, a gazelle wakes up. It knows it must outrun the fastest lion or it will be killed. Every morning in Africa, a lion wakes up. It knows it must run faster than the slowest gazelle, or it will starve. It doesn't matter whether you're a lion or a gazelle—when the sun comes up, you'd better be running.
>
> — Author Unknown

by Allen Chao

This inspirational quote has been etched in my mind since I've started running. Even though I do not have to contend with a hungry lion ready to eat me, I still run. I enjoy the rush from cross-country, the sweltering heat blazing on my neck on summer afternoons or the mist disappearing before my eyes on dewy spring mornings. For me, running cross-country is a competition, a race against myself. It is a source of pride when I beat my fastest time and a force that pushes me onward when I don't.

I started running three years ago, after I saw my older sister practicing her running. At first, I would just watch her run lap after lap after lap in the gymnasium. I was fascinated by her unwavering persistence in the boiling gym. Just strolling through the gym made me sweat, but she seemed oblivious to the heat. Her determination was alive in her eyes, and I asked myself, *What makes her keep running?*



I asked her that question right after she finished, and she said something about a feeling, a force, a drive that she couldn't quite capture in words. This didn't satisfy my pragmatic mind. Curiosity took hold, and the next day, I started to run. It took me only two minutes before I decided to quit. Three laps of gasping for air clearly

wasn't enough to convince me of any noticeable benefits from running. Besides, my feet hurt, and I was thirsty.

Right then, however, I saw my sister steadily running past with that same fierce determination. I glanced around the room and I finally saw, for the first time, the faces of the other runners in the gym. All of them had the same resolve and willpower on their faces . . . and it hit me. Those runners hurt ten times more than I, craved water ten times more than I, felt the pain ten times more than I, but they never let that get in their way. They were invincible.

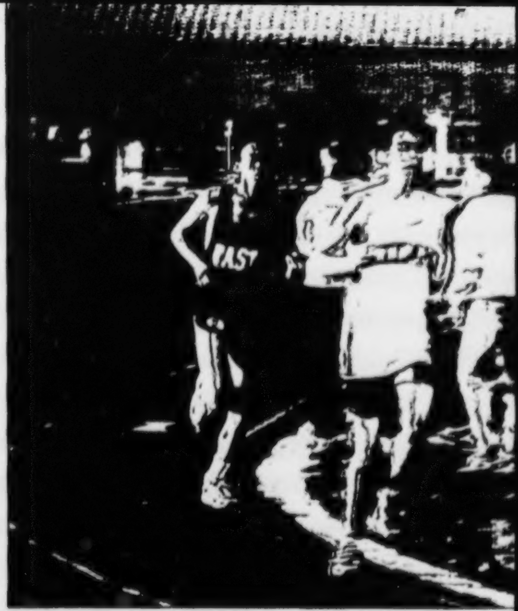
And here I was, sitting on a bench.

The following day, I decided to run again. I didn't get much farther than my three laps on the first day, but I did resolve to persist until I improved. Day after day, slowly, that summer, I began to run. One afternoon, I dutifully followed my sister's instructions to stretch properly. Then she and I started running. It was hard at first—the summer heat made the gym a furnace and my muscles were still untrained. My mouth became dry, my forehead was drenched in sweat, and I started slowing down. *I want to quit*, my body screamed. But my mind countered with a reply to continue running.

Gradually, the humming of the fans and the pounding of my feet melded into a steady rhythm. Suddenly, I wasn't running, I was soaring high in the clouds. The pain had disappeared, my thirst was gone, and I felt free. My state of mind was so calm and peaceful that I wanted to be lost in it forever. Eventually, the pain from my body wore down my intense concentration and in a single moment, I was transported back to the realities of pain and thirst. The swimming pool seemed so inviting. . . .

As a freshman the next school year, I joined our school's cross-country and track team. Since then, each day after school I run for two hours. I run not because I'm fast, but because each step is a source of pride. I run not because I am competing for a top place in major meets, but because each competition is a test of my spirit against my mind and my body. I run because each time, I achieve victory just by crossing the white finish line.

The motto of our school's cross-country team is "Longius, Fortius, Citius." It is a Latin phrase which reminds us to run longer, faster, and swifter. It makes me do my best in every aspect of running, from the warm-ups to the cool-downs. I strive against myself and my speed, and when I overcome the barrier of resignation, I feel invincible.



Allen runs the last lap of the two-mile at a regional meet.

Cross-country running has evolved into something much more than a simple extracurricular activity. It has become a passion, and has transformed into a force that has shaped my personality and goals. Whether I am running through a verdant golf course in the early morning or with the buzzing of a treadmill in the gym, I always find the same pure focus and peaceful calm within myself. Sometimes, the heat, wind, or simple exhaustion still threatens to beat me, but the spirit of cross-country compels me to just keep running—like the lion and the gazelle. ■

Allen Chao, 16, is a junior in the International Baccalaureate program at Wichita East High in Wichita, KS. He enjoys cross-country, track, debate, forensics, and piano. He is an officer in National Honor Society, Students Against Drunk Driving, and Student Government. He competes in Science Olympiad and Scholar's Bowl. He is the Wichita Youth Symphony's principal percussionist and a USA Math Olympiad qualifier.

FROM SOCRATES to SARTRE

The U.S. Academic Decathalon

Fondly called Acadec by avid decathletes, the United States Academic Decathlon is a competition in which teams of nine students take part in ten tests: Math, Language and Literature, Music, Science, Super Quiz, Economics, Art, Essay, Interview, and Speech. This year Amy Lee's team went to the Nationals in Anchorage, Alaska, for some new adventures, good friends, and friendly competition.

by Amy Lee

I could barely see more than ten rows to either side from my seat, but I could definitely hear the approximately 500 other students—either making new acquaintances or frantically quizzing their teammates on topics ranging from Socrates to Sartre. I still couldn't believe I was there. When our team placed second at State last year, I became even more determined to make it to Nationals *this* year. And now, here we were.

All of our hard work finally paid off. After winning the state round, our team was off to the national competition in Anchorage, Alaska, for four days of tests, fun, and meeting new people.

The first day was primarily for registration, so we had time to do some exploring and to meet some of the other team members. I met almost a dozen teams that day, including those from Rhode Island, Idaho, Wyoming, Hawaii, and Alaska. That's one of my favorite things about Acadec: You get to meet lots of people from around the nation, and most of them are very friendly, outgoing, and incredibly interesting.

The next day we had to wake up at 6 a.m. for the 50-minute essay-writing portion of the competition. Although I was nervous about what to expect on the essay section, I was pleased to see that I could easily answer the essay topics. There were three prompts on the 2001 Super Quiz topic, "Understanding the Self," and two prompts from *Frankenstein*, the required reading this year. We continued our testing with the Math and Language and Literature tests, then had a break for lunch.

The afternoon was particularly eventful for me because of the speech competition. This is a favorite of mine since I love public speaking. The speech competition allows you to show off your skills with a prepared speech and have fun with an impromptu speech. I performed the same speech I used to win second place at State. After having so long to memorize the speech, not only did I know it backwards and forwards, but my parents could even recite portions of it to me!

The rest of the day was free for studying and sightseeing. My sister and I (she was also on the team) saw a bunch of Acadec students at the Alaska Experience Theater, part of an earthquake museum. We went into the museum and decided to watch the earthquake documentary. The theater was designed to simulate the huge 1964 Alaskan earthquake by shaking the seats in sync with the footage. Having been through a real earthquake less than a month ago, I wasn't sure if it was more frightening or fun!

After the movie, I tried to study for the next day's tests, in hopes that I might win some monetary awards for placing in the top three. I headed to the lobby, but instead of getting a chance to review the study guides, I ended up talking to some of the other students.

The next day started with the rest of the subject tests and then we had free time. I got to explore Anchorage some more and meet several more teams while waiting for the speech showcase that night.

The speech showcase was definitely special. Twelve students, selected by the judges from the previous day's speech competition, performed their speeches—complete with well-placed gestures that helped draw the audience in. One boy demonstrated his dancing skills while another kid reenacted his meeting with a poverty-stricken boy in India. The speech topics were extremely varied and fascinating, with students talking about things ranging from their love of language to the uses of Silly Putty.

Finally we reached the oral round of the Super Quiz. Each team member went up and sat at a seat labeled with their state and school's name. The former mayor of Anchorage read five questions and the competitors had 15 seconds to answer each one. As the students filed onto the stage one at a time, I knew the Alaskan trip was coming to an end. But the night officially ended with the awards banquet. All students sat tensely as they waited to see if their names would be projected onto one of the two large screens in front of the room, announcing their placing in an event.

Although our team didn't win, it was an experience I'll never forget. I met so many wonderful people, learned lots of new things (the night before the math test, I finally figured out what a quaternion was!), and enjoyed myself thoroughly. ■

Amy Lee **is a 15-year-old senior at Olympia High School in Olympia, WA. She regularly participates in math and music competitions, and has twice been a national finalist in the MTNA string solo competition. Amy also likes playing tennis, swimming, skiing, hiking, camping, journalism, volunteering at memory care homes, and most of all, enjoying the outdoors with friends.**

QUIZ BOWLS

High School Bowl

High School Bowl is available for local license either as a TV series or as a non-broadcast event. There are two types of questions: toss-ups and team bonuses. *High School Bowl, Charles Henderson, College Bowl Company, Inc., 6324 Variel Avenue, Suite 313, Woodland Hills, CA 91367-7773; (800) 234-2695 x 115; www.collegebowl.com*

Knowledge Master Open

Teams of students (team size is unlimited) in grades 5–12 compete nationally and internationally on a computer at their own schools. Students answer 200 questions in 15 categories: American History, World History, Government, Recent Events, Economics and Law, Geography, Literature, English, Math, Physical Science, Biology, Earth Science, Health and Psychology, Fine Arts, and Useless Trivia. The KMO is held twice each year. *The Knowledge Master Open, Academic Hallmarks, P.O. Box 998, Durango, CO 81301; (800) 321-9218; www.greatauk.com/kmo.html*

National Academic Championship

A fast-paced high school competition for teams of four players and at least one alternate. To compete, each team must have won an academic competition of at least 8 teams, been a finalist of a tournament of at least 32 teams, or be able to demonstrate that they are the best of 16 teams. Also, any school ranking in the Top 33 at last year's National Academic Championship automatically qualifies. The competition consists of toss-up questions, team bonus questions, and team 60-second questions. *National Academic Championship, 6959 Candace Place, Worthington, OH 43085; (614) 848-5113; www.qunlimited.com*

Panasonic Academic Challenge

A slower-paced high school competition for teams of six students (four players and two alternates), who are quizzed in seven categories: Mathematics, Science, Language Arts, Social Sciences, Fine Arts, Foreign Language, and Technology.

Each member of the first-, second-, and third-place teams receives a ring and $2,500, $1,500, and $500, respectively. Six students are then selected to form the All-America Academic Team, and each member receives a medallion and $1,000. *The Panasonic Academic Challenge, Peggy B. Harrod, Tournament Director, P.O. Box 391, Bartow, FL 33831; (863) 534-0213; www.academic-challenge.org*

Quiz Bowl Tournament of Champions

A high school competition for teams of four players (alternates are allowed and coaches may substitute players) who have won a tournament. Teams are not eliminated until they have been defeated three times or until they reach the 32-team single-elimination championship round. The tournament games consist of toss-up questions, team bonus questions, and team 60-second questions. *Quiz Bowl Tournament of Champions, American Scholastic Competition Network, 800 5th Street, Suite 125, Sioux City, IA 51101; (800) 252-4289; www.morningside.edu/ascn/tourn.html*

U.S. Academic Decathlon

The United States Academic Decathlon is a national high school competition for teams of nine students, who are tested in ten categories: Art, Economics, Essay, Interview, Language and Literature, Mathematics, Science, Social Science, Speech, and Super Quiz. Gold, silver, and bronze medals are awarded for individual events and total scores. *U.S. Academic Decathlon, 10882 Kyle Street, Los Alamitos, CA 90720; (562) 626-0092; www.usad.org*

U.S. Academic Triathlon

A five-person challenge for students in grades 5–12. The season consists of three round robin meets, plus regional play-offs and state tournaments. For the first event, teams receive a box full of potential backdrop and prop materials, with which they have 40 minutes to come up with their best show. In the second event, individuals or teams must come up with quick, creative solutions to 3–5 short problems. And in the "face-off," teams answer questions about several academic topics, current events, and consumer issues. *U.S. Academic Triathlon, Peggy Sheldon, National Coordinator, National Office, P.O. Box 1765, Minnetonka, MN 55345; (612) 934-1438; http://tigger.stthomas.edu/edsl/usat*

One for the Books

Team USA's Oaz N
with competitors fro
around the world at th
opening ceremony
the IMO, presented b
the Akamai Foundatio

The 2001 International Mathematics Olympiad

by Carol Blackburn

On July 4, as people across the U.S. gathered for fireworks and celebrations, another gathering, another celebration, was taking place in the nation's capital. A record number of the world's best young mathematicians—475—from a record number of nations—83—came to Washington, D.C., to participate in the 42nd International Mathematics Olympiad (IMO), the most prestigious high school mathematics competition in the world. And by the end of the competition, another world's record had been set.

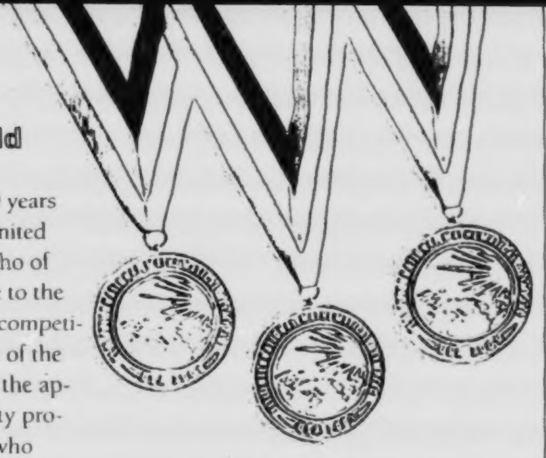
We Are the World

The opening ceremony, hosted by Akamai Foundation, began with "The Parade of Nations," in which representatives from every delegation came on stage. It included an address by Harvard University mathematician Arthur Jaffe, who commended the contestants for being chosen to represent their countries at this event, and emphasized, "A medal for an athlete is the pinnacle of a career. In contrast, for you it would represent the beginning of a lifetime of scientific achievement." The ceremony ended with a rendition of "We Are the World," sung by the Morgan State University choir. "The opening ceremony was stunning, and the feeling of community was tremendous. Everyone was in tears by the end of it," said Mark Saul, one of the IMO 2001 organizers.

Bringing together exceptionally talented young mathematicians from around the world to meet one another and to share intellectual and cultural experiences is one of the major goals of the IMO. "The students bonded quickly, even when relations between their nations were strained," Saul commented. "Students from all the Chinese-speaking teams—China, Taiwan, Hong Kong, Singapore, and Macao—fraternized, as did the Croatian and Serbian teams. And the Spanish-speaking teams became a real contingent. The last night, at the awards ceremony, whenever someone from one of their countries won a medal, the whole group cheered."

But before they could win any medals, the competitors had two days of demanding exams to face. They each had to solve six proofs or essay-style questions over two days; both days, they had four and a half hours to solve three questions. They then spent two days on guided tours of Washington, D.C., while their exams were scored and they waited to learn the results.

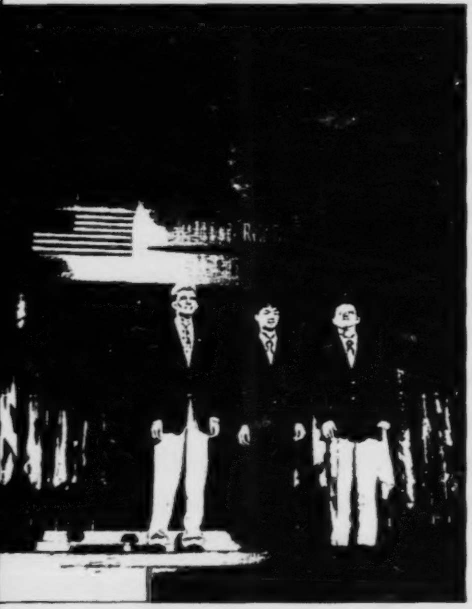
The U.S. was represented by Reid Barton, 18, from Arlington, MA; Gabriel Carroll, 18, from Oakland, CA; Ian Le, 18, from Princeton, NJ; Tiankai Liu, 15, from Saratoga, CA; Oaz Nir, 17, also from Saratoga, CA; and David Shin, 17, from West Orange, NJ. They outperformed more than 350,000 other U.S. high school students in the national American Mathematics Competitions to be chosen for the U.S. IMO team, with Barton having earned a perfect score on the USA Mathematical Olympiad (USAMO), placing first for the second year.



Role Models and Gold Medals

This was the first time in 20 years that the IMO was held in the United States, and a veritable Who's Who of American mathematicians came to the closing ceremony to honor the competitors. For many contestants, one of the highlights of the ceremony was the appearance by Princeton University professor Andrew Wiles, the man who found a proof for Fermat's Last Theorem. Wiles, a reserved man who rarely makes public appearances, was greeted with cheers by the young mathematicians from around the world. "You can tell by the response here that he is a hero among the math community," said U.S. team member Oaz Nir.

After Professor Wiles's address, the IMO medalists were announced. Four members of the U.S. team won gold medals—Barton, Carroll, Le, and Liu—while the other two team members won silver medals. But Barton and Carroll did not just win gold medals: they had perfect scores. For that accomplishment, they and the two Chinese competitors with perfect scores were honored by the Clay Mathematics Institute with a special award, which included a state-of-the-art notebook computer.



USA's Reid Barton and China's Zhiqiang Zhang and Liang Xiao are recognized for their perfect scores.

This was not the first gold medal for either Barton or Carroll. Both won gold medals in 1998, when they were both just ninth graders. Barton went on to win gold medals in 1999 and again in 2000, becoming the first American—and one of only 25 people in the history of the IMO—to win three gold medals. With his perfect score this year, he became the first person ever to win four gold medals in the IMO.

A humble, soft-spoken young man with no desire for limelight, Barton "competes in the USAMO and IMO competitions because he loves the extremely interesting and challenging problems he encounters," said his mother. "Math competitions are where he has found peers who share his passion for mathematics." This fall, when he enters MIT, he will find more kindred spirits—some of whom he already knows from math competitions.

Five of the six members of the 2001 U.S. team were seniors, so this was their last year to compete in the IMO. Next year's IMO will have new faces and new stories. But the thrill of this remarkable IMO will not soon be forgotten.

For more about IMO 2001, see: www.imo2001.org/
For more about the American Mathematics Competitions (AMC), see: www.unl.edu/amc/ ■

Post Script: Make that Two

On July 13th, Reid Barton received the top award at the IMO. The next day, as IMO competitors boarded planes for home to recover from the arduous week in Washington, Barton was on a plane to Finland to compete in another olympiad, the 13th International Olympiad in Informatics (IOI). At last year's IOI, Barton won a gold medal, and in so doing became the first American ever to win gold medals in two different olympiads.

Students from 73 countries came to solve the programming tasks set for them by their Finnish hosts. "The host country chooses the problems for each IOI, so every competition is different," explained Don Piele, the director of the U.S. delegation. "The fact that you don't know what kinds of questions will be asked makes the IOI very interesting. You have to be broadly prepared."

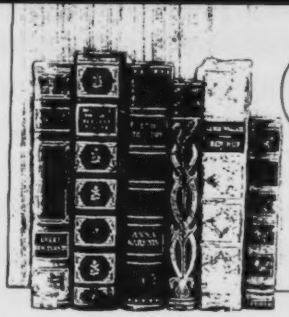
After two long days of testing, contestants eagerly awaited the awards ceremony, where the scores were announced for the first time. The bronze medals were awarded first, one of which went to U.S. team member Steven Sivek, 17, from Burke, VA. Next, the silver medals were awarded, two of which went to U.S. team members Vladimir Novakovski, 16, from Springfield, VA, and Tom Widland, 18, from Albuquerque, NM. Then the gold medals were awarded and finally the top three medalists were announced. In third place, China's Ziqing Mao, with a score of 485. Second place, Romania's Mihai Patrascu, with a score of 525. And first place, Reid Barton, with a whopping 580 points out of a possible 600.

"The crowd went wild when Reid's score was announced," Piele said. "This was the biggest gap between first and second place in the history of the IOI. The top scorers are usually within five points of each other. Reid was 55 points ahead of the second place winner and almost 100 points ahead of the third. It was very dramatic."

"The problems were particularly difficult this year; they were very mathematical," Piele continued. "The fact that the problems were so difficult made it possible for Reid to pull so far ahead of the others. Understanding math as well as he does undoubtedly helped him think about how to solve the problems."

With his first place finish, Barton set another record, becoming the first U.S. contestant to win the IOI. First prize award? A laptop computer. Piele smiled as he said, "In the space of a week, Reid went from having zero laptops to two."

For more about the 2001 IOI, see: www.ioi2001.edu.fi/
For more about becoming a U.S. IOI competitor, see: www.usaco.org

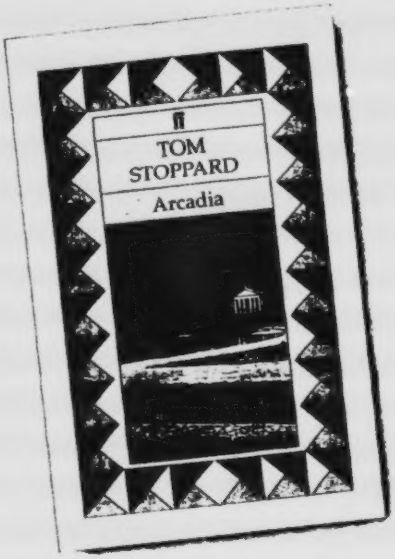


Off The Shelf

Review by Michael Miller

"It's *all* trivial!" exclaims a character in a moment of exasperation in *Arcadia*, Tom Stoppard's brilliant play that weaves together Byron, chaos theory, the second law of thermodynamics, changing fashions in landscape design, and the problem of free will. *Arcadia* is built upon intertwined layers of time and trivialities, showing how seemingly trivial events can have enormous unforeseen consequences. A sparkling display of verbal virtuosity, *Arcadia* is by turns funny, poignant, and profound.

The play jumps back and forth between two stories, both occurring in the same room in an English manor house, one in 1809 and the other in the present day. The modern story includes a murder mystery, a turtle named Lightning, and three scholars who are combing the Sidley Park library on different but, as it turns out, related historical searches. Bernard, a peacock of a man, believes, on the basis of a few shreds of evidence, that he has solved the mystery of Lord Byron's sudden disappearance from England: he fled after killing a man in a duel at Sidley Park. Hannah is researching a mysterious hermit who lived on the grounds of Sidley Park for 30 years, seeing in him a peerless symbol of the Romantic mind: a hermit installed on the estate in an effort to transform the orderly English grounds into a brooding, Romantic tableau. Valentine, the young lord of the manor and a graduate student in mathematics, is searching for patterns in the estate's hunting records, although his efforts to explain fluctuations in the grouse population are thwarted by the fact that the historical record is incomplete and hard to read.



The audience sees not only the modern investigators and the (sometimes wildly inaccurate) inferences they draw about the past, but also events taking place in 1809. The heart of the play is the relationship between 13-year-old Thomasina, the intellectually precocious daughter of the manor, and Septimus, her tutor. The play begins with a whimsical discussion about sex ("Septimus, what is carnal embrace?" "Carnal embrace is the practice of throwing one's arms around a side of beef"), but quickly segues into a philosophical discussion of free will. When Thomasina asks whether Newton's laws negate free will, Septimus is brought up short. Later, his confidence in an orderly world is further undermined by Thomasina's discovery of the second law of thermodynamics, the idea that the entropy or disorder of the universe is constantly increasing. He despairs that he cannot disprove Thomasina with "good English algebra" and so rescue the future of the world.

The play has a recursive structure, with events in one era influencing those in the other. Many integral events in the past are revealed to the audience only in the present-day scenes, forcing the audience to use knowledge from both eras to unravel the historical plot. Appropriate to a play concerned with the impact of trivial acts, the plot is advanced by jokes and asides, beginning with a discussion of Fermat's Last Theorem—the ultimate marginal comment—all the way to a casual joke made in 1809 that humiliates Bernard almost 200 years later.

In both time frames, the characters ponder the inherent conflict between free will and determinism. Stoppard uses concepts from chaos theory—ideas only glimpsed by Thomasina, but familiar to Valentine—to suggest how the world can be both deterministic and chaotic at the same time. As Valentine finally says, "The unpredictable and the predictable unfold together and make everything the way it is."

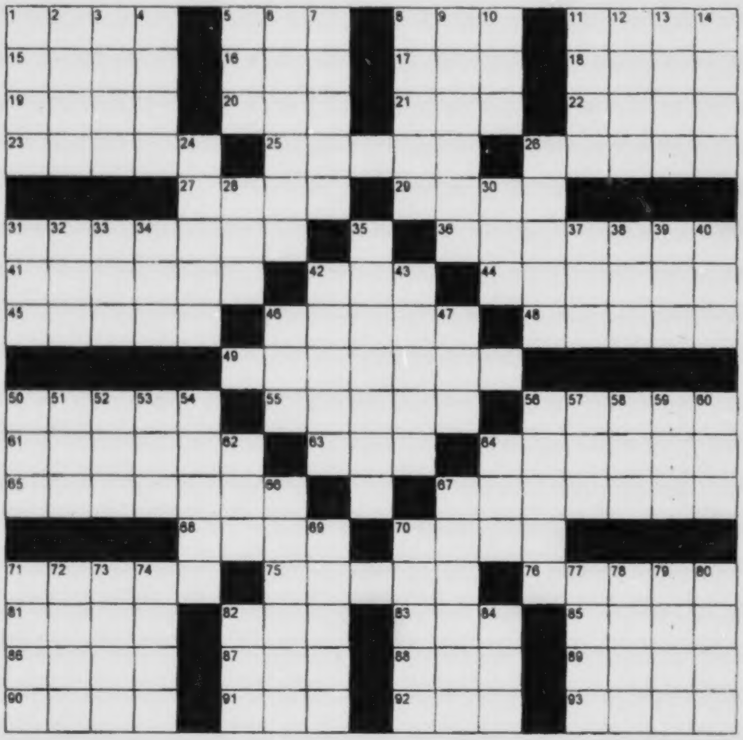
The second law of thermodynamics predicts a gradual deterioration of order in the universe. However, in the meantime, we may take comfort in knowing that order and disorder can intermingle, and the laws of mathematics can create beautiful recursive shapes. In the beautiful, recursive *Arcadia*, Stoppard mimics and improves on the beauty of nature, illuminating not only how events occur, but how we learn and how we learn to cope with chaos in our everyday lives. ■

Michael Miller **is a senior at The Westminster School in Atlanta, GA, where he is editor-in-chief of the school newspaper, captain of the math team, and a member of the cross-country and track teams.**

Word Wise

It's Showtime

by Carol Blackburn



ACROSS

1 "What fools these mortals be" speaker
5 Tread the boards
8 American English (abbr.)
11 Don Juan De Marco
15 Resound
16 __ de France
17 *My Name is Asher* __
18 Matinee __
19 Mr. Arkin
20 *Crying Game* actor
21 Dined
22 Space agency
23 *Tootsie* star
25 Mr. von Stroheim
26 Arther Miller's salesman
27 Young girl
29 Kind of nut
31 "O, I am __'s fool!"
36 "I'm ready for my closeup now, Mr. __"
41 Ms. Plummer
42 Politician, for short
44 __ *Harold and the Boys*
45 Aunt (Fr.)
46 *Silkwood* star
48 __ *Holiday*
49 Play about a math prodigy
50 He wrote "The truth is rarely pure and never simple."
55 Silky fabric
56 "It droppeth as the gentle rain from heaven"
61 *The Iceman Cometh* author
63 Ms. Long
64 Iago's pawn
65 Supplicant
67 *The Piano* director
68 *Moulin Rouge* costar
70 *Elizabeth* star
71 Lear's daughter
75 "Full fathom five thy father lies; Of his bones are __ made"
76 Macbeth's title
81 Julia Roberts' Oscar-winning role
82 Ms. Tyler
83 Please (abbr.)
85 Loads (2 wds.)
86 Chekhov heroine
87 Out __ limb (2 wds.)
88 Kind of theater
89 Benicio Del __
90 Bluish green
91 Tech
92 Dog bark
93 *Dead Man Walking* star

DOWN

1 Burst of laughter
2 CA university
3 Jackie __
4 Gorilla "king"
5 "Nor do not saw the __"
6 Monty Python member
7 "And therefore I forbid my __"
8 Unfortunately
9 Stanislavski's acting technique
10 *All About* __
11 Mr. De Laurentiis
12 Cheese
13 Attitude (It.)
14 *A Simple* __
24 Dodge
26 Hedy __
28 Santa __
30 Scifi author
31 Chow Yun-__
32 Tumor (suffix)
33 Kurosawa film
34 Explosive
35 "Good night, sweet Prince" speaker
37 Personals abbr.
38 Long-term memory (abbr.)
39 Ms. Salonga
40 Gray sea eagle
42 Gooey pie
43 1941 movie
46 Married woman
47 Architect Maya __
50 Pan
51 *Jamaica* __
52 *Crouching Tiger* director
53 "Thus with a kiss I __"
54 *Switch* star
56 *Glengarry Glen Ross* author
57 The sixth sense
58 Repetitive stress injury (abbr.)
59 AFL's partner
60 Afar
62 Mr. Ayres
64 __ *on a Hot Tin Roof*
66 French playwright
67 Laura's gentleman __
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Pilot

Photo by Matt Gentry

Interview with Pete Klavik

by Melissa Hartman

In his 14-year career as a pilot in the United States Air Force, Pete Klavik did everything from training student pilots to flying our country's leaders all over the world. Commissioned as a lieutenant in 1986, he left active duty as a major in 2000. Now a pilot for United Airlines, he continues to serve in the Air National Guard. In this interview, he discusses how he almost didn't make it to the cockpit and the amazing career that happened when he did.

A lot of kids say they want to be a pilot when they grow up. Were you one of those kids?

Definitely. When I was seven years old, I watched Neil Armstrong land on the moon. Ever since then, I've been fascinated with aviation.

But when I was in fourth grade, I had a vision screening test in school, and it showed a deficiency in my color vision. The doctor told me that it would never be a problem unless, of course, I wanted to be a pilot. I was crushed. But I knew I still wanted to do something with aviation, so when it came time for college, I studied aerospace engineering at University of Maryland.

So how did you end up in the Air Force?

I saw some of my classmates in Air Force ROTC uniform, and I started talking to them about it. They encouraged me to take a physical. First I had to take the Air Force Officer Qualifying Test, and after I passed that, they called me back for the physical. It turned out that the color deficiency was very minor. I passed, and I was ecstatic. Now I could fulfill the dream I'd had since childhood.

Did you enlist in the Air Force then?

No, because to be a pilot in the Air Force, you have to be an officer, and you need a degree to be an officer. You don't need a technical degree, but it helps. So I finished my degree in aerospace engineering.

There are many ways to become an officer. After college you can join the Air Force, Air National Guard, or USAF Reserves and go through Officer Training School; or you could go through the Air Force Academy. Or you can go through either a four-year or two-year program in ROTC while you're in college, like I did.

What demands did ROTC put on you as a college student?

One day a week, all of the ROTC students got together before the school day began to practice marching and military drills. I also took a three-credit military education course each semester I was in the program. In the summer before junior year, I had to go to a six-week camp. It's like boot camp, but it's designed for college students training to be officers. Then, when I graduated from college, I was commissioned as an officer.

Where did you go after graduation?

There were quite a few candidates waiting to go to pilot training, so I had ten months off. I worked as an engineer until I was assigned to Williams Air Force Base in Arizona for pilot training.

Pilot training lasts for 51 weeks. During that time you have a month of ground school, which covers everything from basic aerodynamics to advanced instruments and navigation. You go through parachute training,

ejection seat training, and physiological training.

The days are long: you can be in class at 5:00 in the morning until 5:00 at night with only a break for lunch. At night you have to study for the next day, because whatever you learn the next day will probably build on what you did the day before. I remember getting home, working out, and then studying for another four hours a night. So in all, you put in something like a 16-hour day.

Did you also do simulations in ground school?

Definitely, because things can and do go wrong in airplanes, and you have to be trained for problems and emergencies. The simulators are about 20 feet above the ground on hydraulic lifts, and they have six-axis motion, so you can get the sensation of flying, of stopping and starting. All the gauges and instruments and lights work, and you practice using them in different simulated situations. You get all that training long before you get into an airplane, which is about five weeks into the program.

And every time you do an event like this, you're evaluated. You're being instructed of course, but your ability to soak in the information is being evaluated as well. If you fail three flights in a row, they'll start wondering if there's a weak area you might not be able to overcome. This adds a lot of pressure, because you realize that you're maybe three flights away from failing but 100 flights away from succeeding.

When I went through, the success rate was about 60 percent. Military aviation training is accelerated. It allows for mistakes, but it has a standard learning curve, and people who can't keep up with that curve just don't make it.

What was your favorite part of pilot training?

The coolest thing I think all military pilots do in pilot training is to fly in formation three feet away from another airplane. You're hurtling through space at about 400 miles per hour in a T-38 that weighs about 12,000 pounds. You rotate positions, but you stay that close together for an hour and 15 minutes. We train to fly the same basic maneuvers you see the USAF Thunderbirds and Navy Blue Angels perform at air shows.

This kind of flying builds teamwork for combat and also prepares you for formation air refueling. Most military aircraft can be refueled in the air. Later in my career I flew heavy cargo aircraft, and I once had to fly nonstop from South Carolina to Kuwait. We refueled twice over the ocean. The primary airplane the military uses to refuel other aircraft, the KC-10, is about 160 feet wide and about 170 feet long. My airplane was about 150 feet wide and 130 feet long. I flew about 15 feet below the KC-10 and had to stay within a 10-foot tolerance left and right and about a 15-foot tolerance forward and back, which is the size of an average living room. I would have to stay in this position for up to 30 minutes—day or night, in all weather conditions—to load up the fuel.

What did you do after you graduated?

I did very well in my class, so I was selected to teach in the T-38. I went to instructor school to learn how to teach. It wasn't something I ever aspired to, but it certainly made me a better pilot. When you have to teach something, you become an expert. I did that for about four years and trained more than 100 students.

Why did you give up teaching?

After four years—I like to think of it as four years of flying upside down—I really wanted to see the world. I realized that the best way to do that would be in cargo transport aircraft. Just after Desert Storm, I flew C-141 cargo airplanes, which weigh up to 325,000 pounds and can carry around 50,000 pounds in cargo. I moved to McGuire Air Force Base in New Jersey and went through a four-month transition course to learn how to fly it; then it took me about a year to upgrade from copilot to commander of the airplane.

That was interesting work—I delivered anything from tanks to humanitarian relief. I remember delivering 45,000 pounds of medical supplies to Tblisi, Georgia, and when we got there, they had no equipment to unload all of the supplies. We had to unload it all by hand. Doing that, I could see the people the supplies were going to. It's pretty amazing to fly halfway around the planet to help somebody. I did that mission for three years.

Where did you go next?

I knew that down the line I wanted to be an airline pilot, so I wanted to keep flying transport aircraft. I applied to a unit at Andrews Air Force Base that flies Air Force Two, the airplane that carries the Vice President, all of the Cabinet members, the First Lady, and the Chairman of the Joint Chiefs of Staff.

Why did you choose that unit in particular?

It's an incredible privilege to take our country's leaders to places around the world where without me or people like me, they would not be able to do their jobs. It's the pinnacle of cargo and transport flying. Not very many people get the opportunity to do this—only about eight people at a time are designated capable of commanding Air Force Two. Pilots for Air Force One are selected from this unit.

Air Force Two is now a 757, but when I first got there we flew 707s. Presidents Kennedy, Johnson, Nixon, Ford, Carter, Reagan, and Bush all flew on the very same airplane that I flew. It was like I was flying history.

Last fall, I flew Vice President Gore during the campaign. In the last two weeks, he was working 24-hour days, sleeping on the airplane three or four hours at a time, and then he'd get off and keep moving.

It's very exciting to be part of something that's so much greater than yourself. I flew Air Force Two for six years, and the last two weeks of the Presidential campaign were my most memorable.

Why did you decide to leave the Air Force?

When I first started, it was just my wife and I, but a few years later we had kids. The military doesn't always allow you to plan ahead for family time and events. I wanted more time with my family, and as a commercial airline pilot, I have a lot of time off and I know my schedule almost two months in advance. My 7-year-old twins and my 9- and 11-year-old kids can look at the calendar and know when I'm going to be home. The ability to schedule my life was the biggest reason I left. But it was a tough decision because I really enjoyed my time in the military.

What was the process for becoming a commercial airline pilot?

It starts with an application and interviews. You need at least a four-year degree to apply, and there's even a box on the application to check off for master's degrees and other higher education beyond college. Just like any job application, the more boxes you check, the more competitive you are. So that and my Air Force qualifications got me in the door.

There are also many opportunities for pilots with civil aviation backgrounds. Several universities have bachelor's programs culminating in an aviation degree along with all the licenses required and fundamental flight time and skills to become a commercial airline transport pilot.

Once I was hired, I had to go through a five-week course that was approved by the Federal Aviation Administration to learn to fly a 727. That entire course was done in simulators, so the first time I flew the airplane, it was with passengers.

How is flying for a commercial carrier different from flying in the military?

In the military, I was an officer first and a pilot second. I had a lot of responsibilities outside the airplane. For example, when I first went to Andrews Air Force Base, I identified a weak area in the training program and then was asked to fix it. I worked for about a year to develop a training curriculum. A few years later, when they were phasing out the 707 and bringing in the 757, they asked me to help develop training programs for it. I spent a year and a half of my life working on this program; it required me not to even fly for almost six months because I had to focus on training and curricula.

As an airline pilot, flying is literally my only job. Everything else is prepared for me. I can show up maybe 45 minutes before an airplane takes off and have it ready to go with passengers onboard and all the checklists complete. In the Air Force I would have had to show up at least two hours early to flight plan, obtain all my weather, and obtain and verify my flight plans.

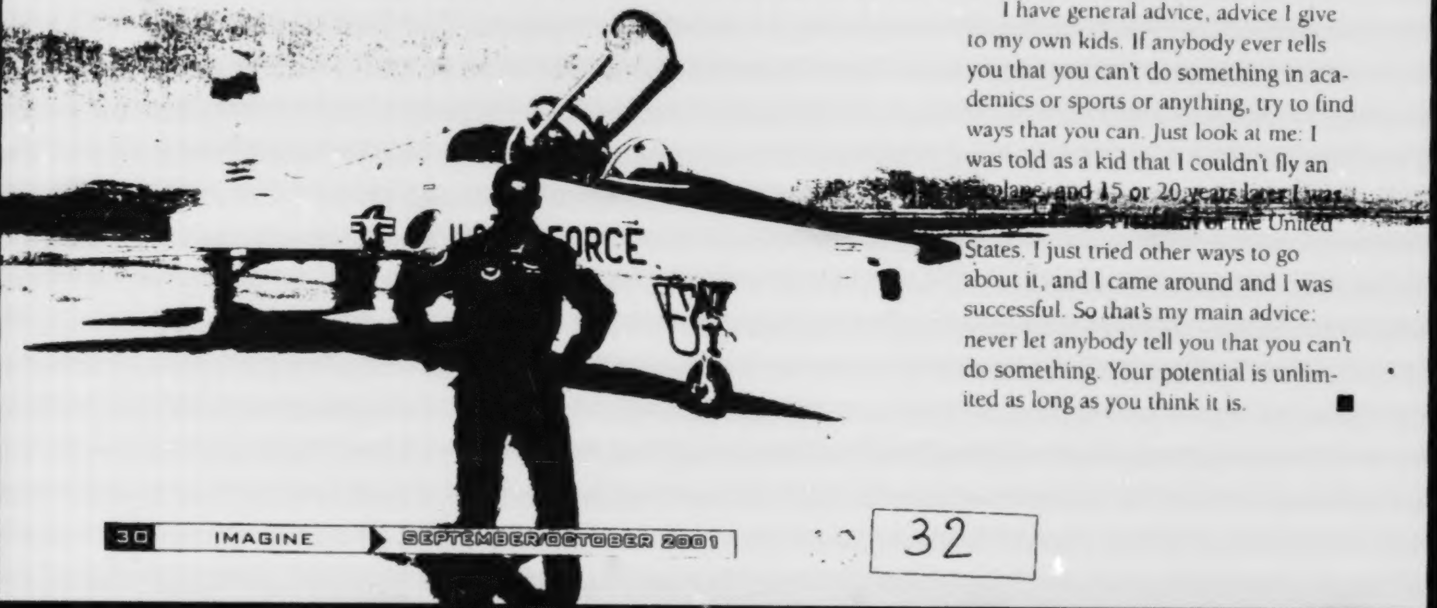
I'm also flying a lot more now. I was averaging 35-40 hours a month in the Air Force; the average airline pilot gets 75-80 hours a month. In the Air Force I was gone anywhere from 10 to 14 days a month, but when I wasn't flying, I had to go into the office. Now, I'm gone about 15 days a month, but when I'm home, I'm home.

What are your goals now?

One long-term goal is to be a captain of a commercial wide-body aircraft, but a lot of that has to do with time and seniority in the company. When I left active duty, I joined the Air National Guard, and I hope to move up and one day be squadron commander for my unit. I'll focus on that in the next couple of years.

What advice do you have for young people interested in becoming a pilot?

I have general advice, advice I give to my own kids. If anybody ever tells you that you can't do something in academics or sports or anything, try to find ways that you can. Just look at me: I was told as a kid that I couldn't fly an airplane, and 15 or 20 years later I was [illegible] of the United States. I just tried other ways to go about it, and I came around and I was successful. So that's my main advice: never let anybody tell you that you can't do something. Your potential is unlimited as long as you think it is. ■



Planning Ahead for College

College Planning Schedule: Grades 7, 8, 9

by Linda E. Brody, Ed.D.

Part II for grades 10–12 will appear in the next issue of Imagine.

Academic preparation is the first and most fundamental aspect of getting ready for college. Begin planning your academic schedule in middle school and continue throughout high school so that you will acquire the background and credentials required by the college of your choice.

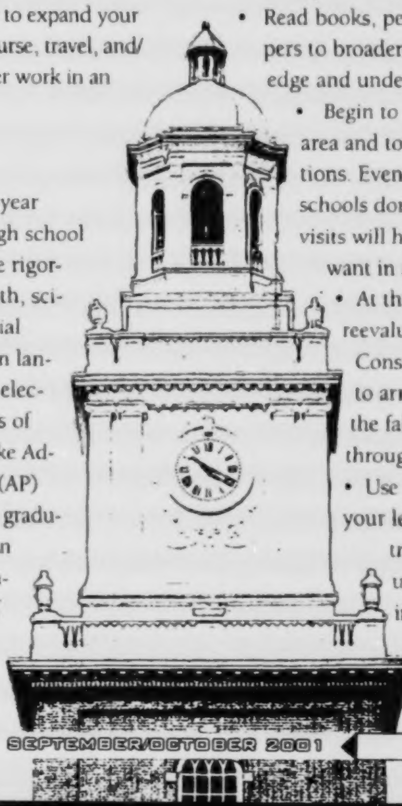
Also set aside time to contemplate your own needs and to investigate college offerings. If you wait too long, you may find yourself as a high school senior, confused about what you want in a college, with no idea of where to apply, and without the course preparation you'll need to succeed. We offer this calendar to help you plan ahead.

Grades 7 & 8

- If you're eligible, participate in a talent search. You will gain insight into your abilities and educational needs, along with information about educational opportunities.
- Take challenging courses. Investigate getting high school credit for advanced courses taken in middle school.
- Study a second language.
- Develop your writing skills through your course work and by writing on your own.
- Develop computer skills, including word processing and programming.
- Consider supplemental educational opportunities such as summer programs, distance learning options, and part-time high school or college courses.
- If you are having any academic difficulties, seek tutorial assistance. If difficulties persist, consider being evaluated for possible learning disabilities. Waiting too long to get help could leave you without the knowledge base to succeed in high school.
- Join clubs and activities that allow you to experiment with new interests.
- Read books, periodicals, and newspapers to improve your verbal abilities and expand your knowledge.
- Investigate career fields through reading, volunteering, and talking to adults about their work.
- Evaluate high school options in your community. For example, is a magnet school or International Baccalaureate program available?
- In cooperation with your guidance counselor, develop a tentative four-year plan of high school courses.
- Use your summer to expand your learning: take a course, travel, and/or pursue volunteer work in an area of interest.

Grade 9

- Review your four-year plan with your high school counselor. Include rigorous courses in math, science, English, social studies and foreign languages, as well as electives in other areas of interest. Plan to take Advanced Placement (AP) courses before you graduate or to enroll in an International Baccalaureate program if available.
- Consider whether summer programs, part-time college courses, or other supplementary options should be part of your four-year plan to provide you with sufficient preparation for college.
- Evaluate your current courses and make changes if necessary. Course work should be challenging and rigorous, but not so difficult that your grades are poor or that you lack confidence in your abilities.
- Seek help in developing any skills you need to succeed in your courses—especially writing, computer, and study skills.
- Participate in extracurricular activities. Begin to identify those that really interest you and in which you might aspire to hold a leadership position.
- Investigate the resources of your school guidance office or career center for college and career information.
- Take a career assessment inventory that gives you insight into your personality and helps you identify career options.
- Take SAT II Achievement tests and AP exams relevant to your 9th grade courses. If you will continue course work in certain subjects, such as English, postpone SAT II tests to maximize your score later.
- Read books, periodicals, and newspapers to broaden your base of knowledge and understanding.
- Begin to visit colleges in your area and tour others while on vacations. Even if these particular schools don't interest you, early visits will help clarify what you want in a college or university.
- At the end of the school year, reevaluate your four-year plan. Consider whether you need to arrange to take courses in the fall at a local college or through distance learning.
- Use your summer to expand your learning: take a course, travel, and/or pursue volunteer work in an area of interest. ■



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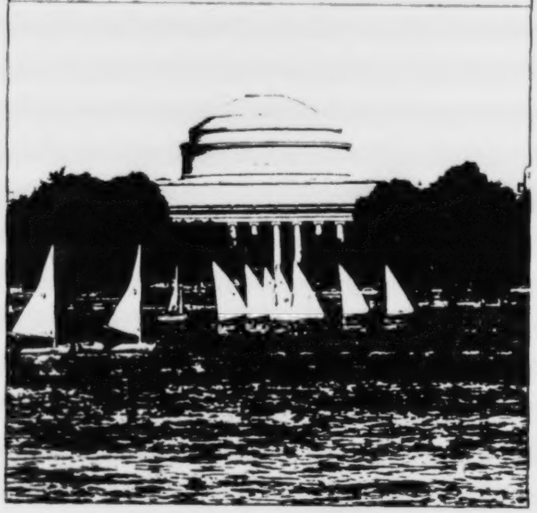
MIT

The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 20 students, who major(ed) in architecture (1), biology (2), brain & cognitive sciences (1), computer science (6), economics (1), electrical engineering (3), math (6), and physics (4). (The number of majors exceeds 20 because several students completed double majors.) Students' comments appear within quotation marks.



Quality of Academic Instruction for Undergraduates

Reviewers unanimously praised the quality of the education MIT offers.

➤ "The academic resources in science and engineering are the best in the world. Most professors will go out of their way to help you if you ask, but it's your responsibility to seek them out (which can be intimidating, like most things at MIT). The students are also very helpful—because *no one* can get through this place by him- or herself."

➤ "Superb. Even when compared with the education provided by other top universities, MIT's undergraduate education is comparable to at least one year of graduate school anywhere else. MIT pushes its students and as a result covers more mature material in the undergraduate years."

➤ "MIT classes are taught at a terrific pace, which has been just right for me. I feel I am being pushed very hard and, in turn, I am learning much more than I would at most other schools. If the classes went any faster, they'd be impossible; but if they went much slower, I wouldn't be learning all that I could."

➤ "Excellent. The intelligence and teaching ability of the professors I've had is phenomenal. The professors are also approachable and available, although access to professors can be kind of limited unless you get involved in an undergraduate research project. It's true that many classes, especially freshman and sophomore years, are large lectures, but I did not find this to be a problem at all. There are small group sessions to accompany the larger lectures."

➤ "The MIT pedagogy values theory over practice, on the assumption that once you are trained in theory, you are well-prepared to apply it in practice. A course in databases will not be about SQL or Microsoft Access; it will be an analysis of database design and implementation. I learned concepts and use them in my work today, and am better informed than my colleagues because of it."

➤ "MIT's core—one term of biology, one chemistry, two physics, two calculus, one lab class, two tech classes outside of your major, three writing courses, and eight humanities courses—provides a strong base for someone who is science-oriented. Classes are challenging (and sometimes seem impossible), but you always come out feeling that you've learned a great deal. Freshman year is Pass/No-Credit, which is wonderful and saves you from going insane."

➤ "MIT is where things *happen*; even we lowly undergraduates sense this. Research is very much in the open, and students are encouraged to join in. MIT has an exceptional, institute-wide Undergraduate Research Opportunity Program (UROP) that provides undergrads with easy, direct access to experience in research groups on the cutting edges in their fields. More importantly, UROP has created the attitude among faculty and graduate students that undergrads should take part in research. I don't think any other school in the nation involves its undergrads in research to the extent that MIT does."

➤ "In addition to its superb resources in science and engineering, MIT has many first-rate faculty in the arts and humanities. (And if you can't find a class pertaining to your interests at MIT, you can cross-register at Harvard.) Because so few MIT students major in these subjects, non-majors get opportunities they would not get at a school with more humanities majors. This means that *you* can get the Advanced Music Performance scholarship or the seminar on Joyce's *Ulysses*."

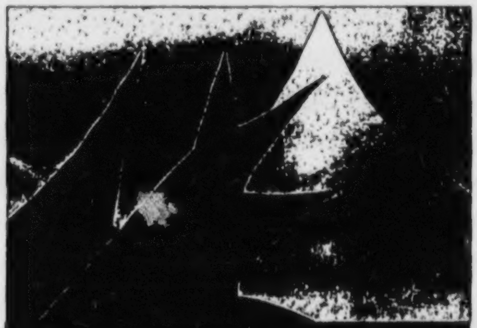
Social Life

In a nutshell, "Everyone here is smart and weird, just like you. It's great." Another reviewer was quick to point out, however, that "MIT really isn't exclusively for computer nerds."

➤ "It's great. The other students are amazing, and I love living in a dorm that faces the Charles River and the beautiful Boston skyline. Boston is the best college town in the country. MIT does not go out of its way to sponsor social events, but with downtown Boston five minutes away, it really doesn't have to. We study a lot, but most of us enjoy socializing, too. The location is great, and students are generally friendly. If you shut yourself up in your room for four years, it's your own fault."

➤ "Social life varies greatly depending on where you live. MIT's social life centers on the living groups. Approximately 50% of students live in about 40 fraternities and Independent Living Groups (ILGs) on campus. All students, including freshmen, decide where they want to live, so all living groups and dorms have distinct personalities. (MIT has rush the first week of freshman year: you live out of a suitcase, meet people, and decide where you want to live for the next four years. Even dorms have rush.) Since students do not move to a new dorm every year, they turn their halls or suites into close-knit communities and develop lasting friendships."

➤ "Whether you immerse yourself in cutting-edge research or in extracurriculars (or both), you get valuable experience. I volunteered at MedLINK peer health advocates and Mediation@MIT, where I learned management and communication skills. Today, I am poised to take a leadership role at the company where I work because I have impressed others with my diplomacy and management skills. Who says MIT graduates have no people skills?"



Massachusetts Institute of Technology

Cambridge, MA 02139
(617) 253-4791

4-year coed private university

Urban campus

Full-time undergraduate enrollment 2000-2001: 2,503 men; 1,755 women.

Special features: UROP, many world-famous research groups (including those in Artificial Intelligence and the Media Lab), 5-year B.S./M.S. programs, cross-registration with Harvard, sailing on the Charles River.

What Do You Like Best About MIT?

➤ "Having a friendly city right across the river is great (Symphony Hall is within walking distance), but what I like best about MIT is its academic excellence. The caliber of the students and faculty is second to none, and I know I am learning cutting-edge knowledge. When I say, 'I attend MIT,' it is said with an enormous amount of pride because I know how much hard work and dedication it takes to be a student here."

➤ "MIT is a true meritocracy. At MIT, it doesn't matter who you are, where you're from, or what you already know. Family connections won't get you through here; intelligence and dedication will. When you graduate, you have a sense of pride and capability—you can do anything after getting through MIT!"

➤ "The people are wonderful and all *very* intelligent. I am convinced that I am getting the best education available. This tends to make all of the hell worth it. Once I survive MIT, I know I can survive anything. This is a nice feeling."

What Do You Like Least About MIT?

➤ "The fact that the demand for academic excellence leads to an atmosphere where everyone is stressed out and overworked. Of course, you can't have it both ways: being at one of the top schools has a price, and the price is hard work."

➤ "This place is very stressful, constantly stressful, and some of it is probably unhealthy. MIT is a great ego deflator; at times, it's very discouraging. I think that, had I gone anywhere else, I would still think of myself as brilliant."

➤ "MIT has no pre-med major or advising program. As a pre-med, I felt basically on my own."

➤ "I found it something of a loss not to be able to get to know and learn from people studying other, dramatically different majors."

Who Would Be Most Compatible with the Academic and Social Atmosphere at MIT?

All reviewers agreed that "MIT is certainly not for everyone."

➤ "Someone who likes numbers—all our courses, majors, buildings, and professors are numbered. Someone who likes science—that's what MIT is all about. And someone who likes hard classes—they're everywhere."

➤ "Someone with academic confidence, not arrogance; arrogance is shattered rather quickly at MIT. There are *lots* of people here who are *much* smarter than you and you have to be able to deal with that. It's humbling, but you can't let it keep you down. Just being a student at MIT is a great achievement in itself. And someone who can deal with failure. Many students who come to MIT have never experienced failure of any kind."

➤ "Someone who is very driven and not easily discouraged. It helps to be outgoing, though many MIT students are not; but MIT is unlikely to bring anyone out of his or her shell."

➤ "Someone with a brilliant, innovative mind who likes to interact with other brilliant minds. Definitely disciplined and hardworking, too. While many people do enjoy their four years here, I wouldn't come to MIT to have a 'fun time' in college—there are many long nights when it's not very fun. But if you're looking for a challenge, looking to be pushed to excel, come to MIT."

➤ "MIT isn't just for computer nerds. One friend double-majored in math and biology, minored in literature, and still managed to fit in Sanskrit at Harvard! No matter what your major, you will meet a lot of bright, interesting, motivated people who share your curiosity about the world."

If You Had It to Do over Again, Would You Go to MIT?

All but two reviewers enthusiastically said yes.

➤ "Definitely! MIT is an awesome place, a hotbed of intellectual exploration and investigation. Though at times it will test your limits, in the end, you will have a strong respect for intelligence and open-mindedness, and a sense of your own abilities and interests."

➤ "Yes, there's nowhere I'd rather be, although every time I get stressed out, I joke about transferring to Harvard. I often think this is an unhealthy place in terms of the level of stress. But I am convinced that I am getting a better education here than I would anywhere else, and ultimately that is the most important thing."

➤ "Of course! There's an acronym that I think best summarizes MIT: IHTFP. It's even engraved on our class rings. It has two meanings: 'I Have Truly Found Paradise' and 'I Hate This ****ing Place.' I've gone through both phases. MIT is unbelievably hard work at times. But once you're through, you look back and love every minute of it."

➤ "I'm not sure. I'm at MIT for architecture, and some of the core is not relevant to my career preparation. I might be happier someplace where I could take more electives in the arts. Prospective students should consider whether the extensive core is appropriate for their interests."

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

BEST COPY AVAILABLE

Mark your calendar...

with these September–November registration deadlines for selected academic competitions. Inquire about competition format, dates, and fees.

SEPTEMBER

HiMCM: High School Mathematical Contest in Modeling—Advisors register teams of up to four students in September; problems posted on Web site in November. COMAP, Inc., 57 Bedford Street, Suite 210, Lexington, MA 02420; (781) 862-7878 x37; www.comap.com/highschool/contests/himcm

Let's Get Real!—Adult sponsors register teams of two to six students for problem-solving contest. Challenges available on Web site in September; solutions due in January. (717) 566-7173; LGReal@usa.com; www.LGReal.org

United States Academic Decathlon—Schools register teams, grades 9–12; state deadlines vary. USAD, 10882 Kyle St., Los Alamitos, CA 90720; (562) 626-0092; info@usad.com; www.usad.org *(See page 22 for an article about this competition.)*

U.S.A. Computing Olympiad—Students in grades 9–12 register online for fall, winter, and spring contests. Don Piele, University of Wisconsin–Parkside, Box 2000, Kenosha, WI 53141-2000; (262) 595-2231; piele@uwp.edu; www.uwp.edu/academic/mathematics/usaco/

SEPTEMBER 28

Mandelbrot Competition—Schools register, grades 9–12. P.O. Box 380789, Cambridge, MA 02238-0789; (671) 661-3188; info@mandelbrot.org; www.mandelbrot.org

OCTOBER

Future Problem Solving Program—Schools register teams, grades 4–12; ask about state affiliates. 2028 Regency Rd., Lexington, KY 40503; (800) 256-1499; FPSolve@aol.com; www.fpsp.org

OCTOBER 15

National Geographic Bee—Principals register schools, grades 4–8. National Geographic Society, 1145 17th St., NW, Washington, DC 20036-4688; (202) 828-6659; www.nationalgeographic.com/geographybee

OCTOBER 30

National German Test—German teachers register, German II-IV. American Association of Teachers of German, 112 Haddontowne Ct. #104, Cherry Hill, NJ 08034; (856) 795-5553; headquarters@aatg.org; www.aatg.org/hsstudentprogs/hsnationalexam.html

NOVEMBER 1

AMC -> 8—Schools register, up to grade 8; lower fee for registering before October 15. Dr. Titu Andreescu, American Mathematics Competitions, Department of Mathematics and Statistics, University of Nebraska–Lincoln, Lincoln, NE 68588-0658; (402) 472-6566; amcinfo@unl.edu; www.unl.edu/amc

NOVEMBER 15

U.S. Senate Youth Program—Each state nominates two delegates and alternates in grades 11–12 who are elected student leaders: Ask your high school principal, chief state school officer, or office of DoD Dependents Schools; also check your state's Web site.

NOVEMBER 19

Knowledge Master Open—Schools enter one team per division (middle, junior high, high school). Academic Hallmarks, Box 998, Durango, CO 81302; (800) 321-9218; kmo@greatauk.com; www.greatauk.com

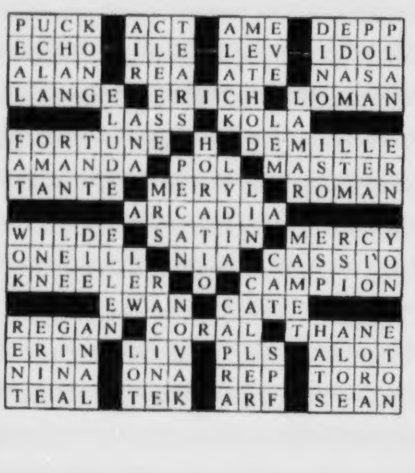
OTHER

National Spelling Bee—Students enter only through a sponsoring newspaper; ask your local press if they participate, or find your local sponsor at www.spellingbee.com/particip.htm

Scholastic Art and Writing Awards—Students in grades 7–12 submit their work in 16 visual arts and 9 writing categories. Regional deadlines vary with some as early as November. 555 Broadway, 4th Floor, New York, NY 10012; (212) 343-6493; a&wgeneralinfo@scholastic.com; www.scholastic.com/artandwriting/

More about ... *Arcadia*

Do you long to read a play in which characters talk about Fermat's Last Theorem and fractals, and exchange lines like, "Do you think God is a Newtonian?" "An Etonian? Almost certainly, I'm afraid." Or in which a character ponders, "If you could stop every atom in its position and direction, and if your mind could comprehend all the actions thus suspended, then if you were really, *really* good at algebra you could write the formula for all the future." If so, Tom Stoppard's Pulitzer Prize-winning *Arcadia* is just waiting to delight you. Need more convincing? Read a review of *Arcadia* on page 26.



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T	E	A	L	■	T	E	K	■	A	R	F	■	S	E	A	N

Creative Minds Imagine

Dreams of Flying

by Richard VanOrnum

Richard VanOrnum, of Cincinnati, OH, wrote this essay for his college applications. He is now a freshman at Tufts University, where he will pursue his interests in creative writing, science, foreign language, and performing arts. He also plans to become involved in journalism, theater, a cappella singing, and improvisational comedy.

When I was little, I dreamed I was flying. Each night I was up in the air, though never over the same landscape. Sometimes, in the confusion of early morning, I would wake up thinking it was true, and I'd leap off my bed, expecting to soar out of the window. Of course, I always hit the ground, but not before remembering that I had been dreaming. I would realize that no real person could fly, and I'd collapse on the floor, crushed by the weight of my own limitations. Eventually, my dreams of flying stopped. I think I stopped dreaming completely.

After that, my earliest memory is of learning to count to one hundred. After baths my mother would perch me on the sink and dry me as I tried to make it to one hundred without a mistake. Whenever I got lost, she'd stop me and make me start all over again from the beginning. I never got bored and I never got frustrated, though I think maybe she did. I'd just keep trying until I got it right or my mother got bored.

I had to be lifted up onto the sink. An accident with a runaway truck when I was four had mangled my left leg, leaving scars that stood out, puckered white against my skin. Looking at the largest of my scars in the mirror, I imagined that it was an eagle. It wasn't fair, I thought. I had an eagle on my leg but I couldn't fly. I could hardly walk, and the crutches hurt my arms.

Years later, in Venice, I had the closest thing to a revelation I can imagine. Sitting on the rooftop of the Cathedral of San Marco, I wasn't sure what life had in store for me. I was up on a ledge, in between the winged horses that overlooked San Marco square. To the left, the Grand Canal snaked off into the sea, where the sun cast long, crimson, afternoon shadows across the city. Below me, in the square, pigeons swirled away from the children chasing them and swooped down onto a tourist who was scattering dried corn. Somewhere in the square a band was playing Frank Sinatra. It was "Fly Me to the Moon," I think.

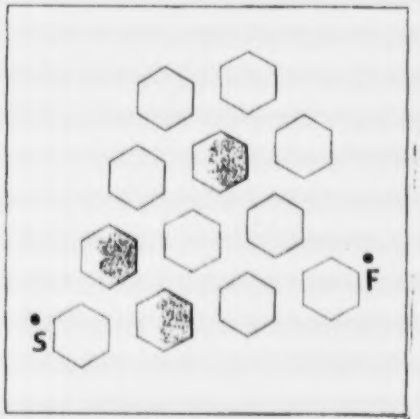
Up on the roof of the Cathedral, it seemed to me the pieces of my life suddenly fell together. I realized that everybody is born with gifts, but we all run into obstacles. If we recognize our talents and make the best of them, we've got a fighting chance to overcome our obstacles and succeed in life. I knew what my gifts were: imagination and perseverance. And I also knew what my first obstacle had been: a runaway truck on a May morning with no compassion for pre-schoolers on a field trip. But I knew that the obstacles weren't impossible. They could be overcome. I was proof of that, walking.

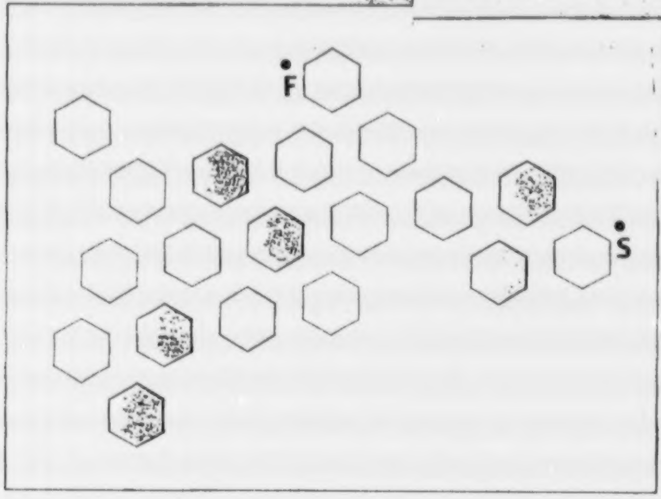
That night, for the first time in years, I dreamed I was flying. I soared through the fields of Italy, through the narrow winding streets of Venice and on beyond the Grand Canal, chasing the reddening sun across the sea.

I woke up sure that it was true.

Knossos Games

by Tim Boester





Move from S to F via the triangles. No stepping on the hexagons!

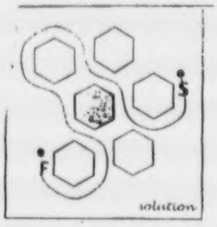
RULES:

- You must move clockwise around orange hexagons and counterclockwise around green hexagons.
- You must alternate "passing" orange hexagons and green hexagons. A hexagon is "passed" as soon as your path touches it, whether along a side or at a vertex. If your path adjoins hexagons of different colors, the one you came into contact with most recently is the one you have most recently "passed."
- You may return to and "pass" a hexagon more than once (and count it in the alternation of green and orange hexagons); and you may retrace your path. However, you may not stop and reverse direction.

The example shows a legal solution path. In the triangle marked with a red dot, the solution path cannot turn left and continue around the green hexagon. Why? Because the next hexagon encountered would be orange, but the most recently "passed" hexagon was also orange.

So the path must fully detach from the green hexagon so that it can encounter it anew and "pass" it again before encountering the final orange hexagon.

Example:



A graduate student in educational psychology at the University of Wisconsin, ***Tim Boester*** now has additional puzzles on his home page: http://homepage.mac.com/boester

Solution to Knossos Games in our May/June issue:

Correction: In the first hexagon, the first number should have been (9,6), not (9,7). The corrected solution is: S:(9,6) - (9,6,4) - (9,6,3) - (9,5) - (9,5,4) - (9,4) - (8,4) - (8,4,9) - (8,4,5) - (8,3) - (8,2) - (8,1) - (8,1,9) - (8,1,2) - (6,1) - (6,0) - (0,0):F

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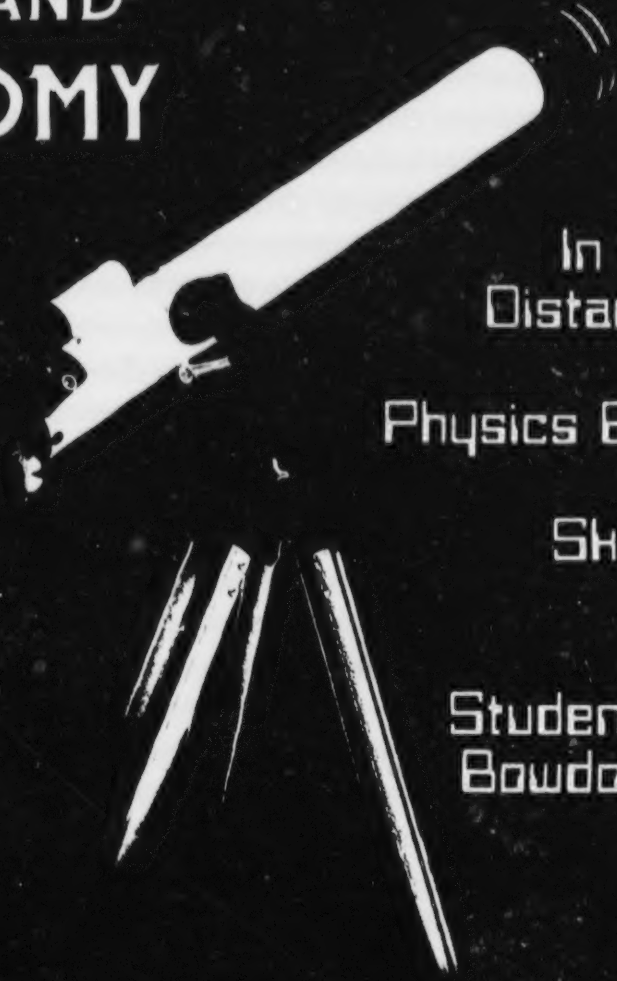
Imagine...

JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

PPORTUNITIES AND RESOURCES FOR ACADEMICALLY TALENTED YOUTH Volume 9 Number 2 • November/December 2001

FOCUS ON PHYSICS AND ASTRONOMY



In Search of Distant Planets

Physics Boot Camp

Skill and Art in Chess

Students Review Bowdoin College

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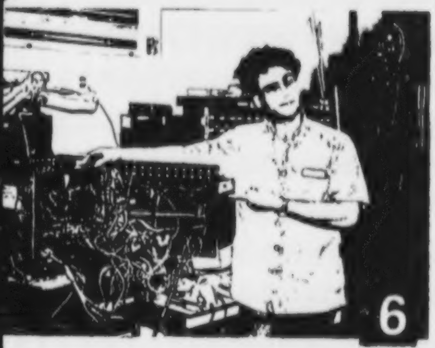
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ImaGiNe...

Opportunities and Resources for Academically Talented Youth*

ISSN 1071-605X Volume 9 • Number 2
November/December 2001

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JOHNS HOPKINS
UNIVERSITY

Center for Talented Youth

Published five times a year—September/October, November/December, January/February, March/April, and May/June

Periodicals Postage paid at Baltimore, MD, and additional mailing offices

POSTMASTER: Send address changes to *Imagine*, P.O. Box 3073, Langhorne, PA 19047.

Imagine is published by the Study of Exceptional Talent (SET) at The Johns Hopkins University Center for Talented Youth.

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Annual subscription: $25.00
Institutions: $30.00

Address subscription inquiries to:
Imagine
P.O. Box 3073, Langhorne, PA 19047
(215) 826-0707 • fax: (215) 788-6887
or order online at www.jhu.edu/gifted/imagine

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over photo of student with telescope by Vilma Lonsdale
igital composite cover illustration by Stephen Kelly-Judd

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Achieving Vision

Imagine a tube with lenses at each end. When you look through one end, you can see beyond our galaxy to vast star-forming regions millions of light years away. When you look through the other end, you can see electrons with remarkable clarity. *Amazing,* you think. *I need one of these tubes!*

Alas, no such tube exists. But there is a way to achieve this kind of vision. It's called physics.

Physics explores the tiniest subatomic particles as well as stars and galaxies. Its domain includes cells and computer circuits, earthquakes and climate change, the human heartbeat and contact lenses. Yet at its center lie two simple questions: *how?* and *why?*

If you're prone to ask such questions, you just might be a physicist at heart. Have you ever wondered why snowflakes are so geometrically perfect or why the moon looks so big on the horizon? Or why you can't microwave metal? Or how sunscreen works? Curiosity about the world around us—how and why things work—is central to physics.

In this issue of *Imagine*, you'll hear from students who've explored physics in summer programs, internships, and competitions. You'll also learn about some exciting work in nuclear fusion and particle physics from researchers who have made some fascinating discoveries. And you'll also hear from physicists who've turned their attention to the skies, studying black holes and searching for planets outside our galaxy. It's an issue filled with possibility, discovery, and opportunity.

Yet when we were preparing this issue, the events of September 11 were so fresh in our minds that at times it was hard to see the significance of what we were working on. What is the point of looking outside our own galaxy, we asked, when larger questions are being asked right here, on our own planet?

Almost by coincidence, in searching for astronomy quotes an answer appeared. Cicero wrote, "The contemplation of celestial things will make a man both speak and think more sublimely and magnificently when he descends to human affairs." This not only addressed our immediate concerns about this issue but also reminded us to look beyond ourselves to maintain perspective. And perspective, as embodied in the "tube" above, is really what this issue is all about.

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Stargazing at its Best

SPACE SCIENCE AND ASTRONOMY AT KOPERNIK

by Sam Kapcio

"On a scale of 1 to 10, that was about a 15," said my friend Colin as we headed back to the Binghamton University dorms. It was the last day of our third summer at the Link Summer Science Explorations at the Kopernik Space Education Center. We had just presented our final projects that we had strenuously worked on all week. I couldn't wait to come back next summer.

My Introduction to Kopernik

The first summer I went to Kopernik was right after 7th grade in 1999. For our project that year, we were asked to imagine that we were life-forms on a planet outside of our solar system, and that we needed to describe ourselves and our planet to the people of Earth. To do this, we needed to figure out how to get our message to reach Earth, using digital imaging and other computer technologies.

My group created a series of astronomical diagrams, like maps, that showed where we came from. We then turned the diagrams into digital files and learned how to put the files into a PowerPoint presentation. At the end of the program, we had to present our ideas to a group of evaluators, who gave us feedback and ranked each group's performance in various categories, such as creativity and completeness.

Throughout the week we attended seminars and labs where we learned about the electromagnetic spectrum, digital imaging, holography, computer enhancement, virtual reality, and computer simulations. The seminars and labs were taught by visiting and on-site experts at the Kopernik Space Education Center. The Kopernik facility has a number of science labs and seminar rooms, in addition to the observatory with its three giant telescopes.

There were noticeable differences between the program at Kopernik and my science classes at school. Although I've always enjoyed science class, there are a lot of kids who aren't interested in the subject, and that slows things down. In contrast, everyone at Kopernik is there by choice, so they're obviously interested in science. You work all week with kids who are like you. And the program is completely hands-on: there are no long stints of note-taking or of listening to teachers drone on. For example, instead of merely studying electromagnetic spectral fields from a textbook, we utilized a variety of light-altering tools like glass tubes and spectragraphs to generate and observe the real thing.

The domes that house the three computerized, high-tech telescopes at the Kopernik facility. From left to right: the 16-inch, the 12-inch and the 20-inch.

Learning the Realities of Space Travel

Our project my second year was to train new international space station astronauts (actually a group of evaluators) for a mission. Once again divided into groups, we had to teach the "astronauts" the fundamentals of living in space and how to complete their mission efficiently.

As in the previous year, there was a lab on computer simulations; but this year, we studied the shuttle-control training equipment that the real NASA astronauts use. In my group, I served as the shuttle piloting and docking trainer. My job was to teach our trainees (the evaluators) how to fly the space shuttle from Earth to a rendezvous with a space station. We also toured DORON Precision Systems, Inc., a company that creates high-tech computer simulations for purposes ranging from entertainment to police and army training.

There were numerous other labs and seminars, focusing on topics including ham radio communications, digital imaging, and piloting spacecraft. For our final projects, we built on our skills from the last summer in creating PowerPoint presentations.

My favorite activity that week was when we learned how astronauts adapt to microgravity environments. We got to go into a microgravity simulator—basically, a big box that jerks you up and down—and experience weightlessness. It's hard to describe, but it felt like I was in a constant state of free fall—sort of like on a roller coaster, but with the full effect.

Looking into Space

I wanted to return yet again because every year the projects seemed to get more and more interesting. And I was right! The 2001 program had the best project yet.

Our group assignment was to create a Personal Star Atlas Web site, containing information on stellar maps that we created. We got the information for our Web site from seminars and labs such as Radio Astronomy, Astrophotography, Equations of Time, Classification of Stellar Spectra, and Astronomy of Asteroids, which taught us about stellar objects and their effect on one another and on us, their observers.

This year I was in the high school program, which focuses on astronomy (the middle school program focuses on space science). The program held several highlights for me. First was the trip to Cornell University, where we learned about NASA's Mars projects. Another was the seminar on Hubble Space Telescope images because I enjoyed seeing the pictures of distant galaxies. But my favorite activity of the week by far was staying up late to become an astrophotographer and observe the night skies until midnight or one in the morning.

I've always been fascinated by stars, galaxies, nebulae, and supernovae, and the ability to take detailed photographs of them made it even more exciting for me. We looked into space using Kopernik's 12-, 16-, and 20-inch computerized telescopes and took pictures (which we developed ourselves) using both short and long film exposures. The Kopernik Observatory is located on top of a mountain, far away from city lights, so our view was unobstructed. It's pretty amazing to look through a high-powered telescope and see a breathtakingly clear picture of hundreds of huge, distant star clusters.

My friend Colin was right about this year's program. It exceeded all expectations in scientific discovery and non-stop fun. The program at Kopernik is great for anyone who is interested in space science and astronomy, meeting kids from around the world, and having a lot of fun on a college campus. ■

Sam Kapcio, 15, is a sophomore at Lafayette High School in New York. Sam spends his time go-kart racing at the local, regional, and national levels, drumming in his punk band, snowboarding, and rollerblading.

Link Summer Science Explorations

The Kopernik Space Education Center offers weeklong science programs, called Link Summer Science Explorations, for students in grades 1-12. Link Summer Science Explorations introduce students to hands-on, high-tech science. Program partners include Binghamton University, Cornell University, and local corporations. Topics vary by grade-level: grades 1 and 2, Introductory Science; grades 3 and 4, Earth and the Sun; grades 5 and 6, Earth Science; grades 7 and 8, Space Science; and grades 9-12, Astronomy.

Only the Space Science and Astronomy programs are residential, and students may choose from a one- or two-week session.

For more information:
Link Summer Science Explorations, Roberson-Kopernik, 30 Front Street, Binghamton, NY 13905; (888) 269-5325 x 208; info@kopernik.org; www.kopernik.org/summerinstitute.htm

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by Bhavna Sengupta -

An internship at NASA seemed like the obvious choice. After all, my school is right down the street from NASA Goddard Space Flight Center. And I knew people who had done internships there in exciting subject areas like engineering, astronomy, and physics.

But at the end of my sophomore year, I was starting to get nervous about how I would fulfill my school's internship requirement. Even though my school is a science and technology magnet, I wasn't sure about my true scientific interests. A summer internship, I decided, could help me figure out what I might want to do for my required internship, without the pressure of school and without spending a whole semester on it. After exploring Goddard's Web site, I sent my application to the Summer Student Programs Coordinator for the Laboratory for Astronomy and Solar Physics (LASP).

The program at LASP, which is really designed for undergraduate and graduate students, accepts only a few high school students. I was thrilled when I learned that I would be one of them!

Answering Cosmological Questions

In 1995, NASA began work on a mission called Diffuse Microwave Emission Survey (DIMES), which will seek answers to some big questions about the evolution of the universe. The data collected through this project could give scientists a better idea of the total mass density of the universe and even help them find the value of the cosmological constant (an important number that is needed to determine the age of the universe) and the Hubble constant (the speed at which the universe is expanding).

My internship focused on a piece of equipment that is critical to DIMES: the Absolute Radiometer for Cosmology, Astrophysics, and Diffuse Emission (ARCADE). Carried by a 10-million-cubic-foot balloon, ARCADE is going to make precise measurements of the low-frequency end of the spectrum of the Cosmic Microwave Background (CMB), the radiation left over from the Big Bang. By mapping the CMB and analyzing fluctuations in it, scientists may be able to gather information about the energy left over from the Big Bang, the composition of and energy in the interstellar medium (the "empty" space between solar systems and galaxies), and dark matter (the unseen 90 percent of matter that makes up the universe).

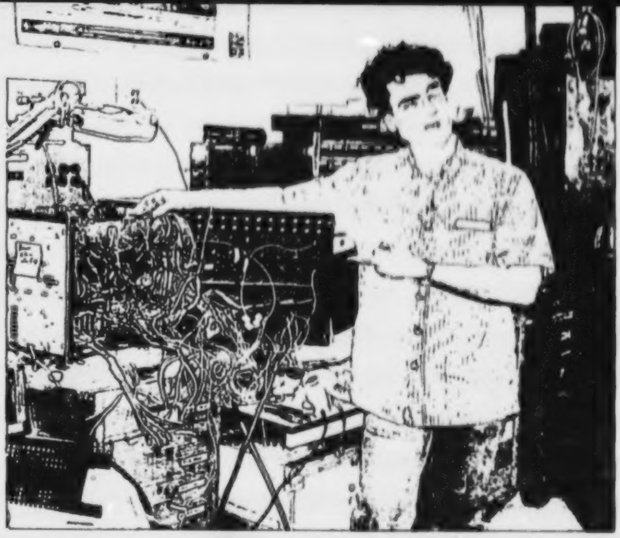
Interns at Work

I immediately began working with the instruments for ARCADE that will record data from the very edge of space. In fact, on my first day I helped assemble the frame that would hold the instruments. On the days after that, I and the other interns built and assembled hardware, prepared the frame for electronic components, made cables, populated the electronic boards, and wired the connectors. I was completely immersed in electrical engineering––and in a project that might advance our understanding of the universe. It was amazing.

Over the course of my eight weeks at NASA, I also worked in a lab on the campus grounds, where we assembled cables to connect different parts of the instrument for ARCADE ... and wired many, many things. I learned how to use a soldering iron and how to work with different electronic parts. I also learned to take measurements with a multimeter: I measured the resistance in a wire in ohms, current in amps, and voltage in volts. In addition, I got a lot of experience applying math skills that I'd only ever practiced on paper. Knowing that our work could effect the success of the mission added some pressure but also a real sense of reward.

Bhavna and her friend Jen on an intern field trip to Baltimore's Inner Harbor.

Space Scientist for a Summer



Paul Mirel, Bhavna's mentor, in his lab next to some of the ARCADE electrical equipment that Bhavna helped to construct.

Jack of All Trades

My summer at NASA also allowed me to explore another interest outside of science: I volunteered as the summer photographer and Web designer for the LASP summer program. As the photographer, I basically had a lot of fun and learned a lot while brushing up on my skills. I took pictures at numerous intern field trips, luncheons, barbecues, and talks, which gave me a great opportunity to meet and become friends with other interns not working in the specific lab I was in.

I especially enjoyed the talks, which included titles like "Having Fun with Space Projects," "What is Space Weather and Why Should You Care," "Life in the Universe," and "The Rewarding Career of a Female Pioneer." The latter, by Dr. Nancy Roman, was particularly inspiring to me, as she spoke about the hardships she faced—and overcame—as a female scientist in her time.

Bringing it Back Home

In my engineering class this semester, I find it really gratifying when my teacher is explaining how power resistors work or how to assemble and ground cables, and I think, *Hey, I already know how to do that!* For the first time in my life, I am actually slightly ahead of everyone in my science classes, and I owe it all to working at NASA.

My summer internship gave me a clear picture of what some NASA scientists do on a daily basis and what their working environment is like. Because I worked in labs where many projects were running, I got to meet and work with people in a variety of careers, and I learned a lot about their fields of study. All of this has helped me decide that I will apply to NASA again to fulfill my internship requirement. I know that I will learn a lot, work with enthusiastic and supportive people, and have the chance to contribute to projects answering some of the most intriguing questions of our time. ■

Bhavna Sengupta is a junior attending the Science and Technology Program at Eleanor Roosevelt High School in Greenbelt, MD. In her free time, she enjoys swimming competitively for the Greenbelt Swim Team, dancing for two different Indian dance troupes, and playing the piano.

Work and Learn at

If you're interested in astronomy or physics ... or math or engineering or computers, consider an internship at NASA. With centers in Alabama, California, Florida, Maryland, Mississippi, New Mexico, New York, Ohio, Texas, Virginia, and West Virginia, NASA offers precollege students opportunities across the country.

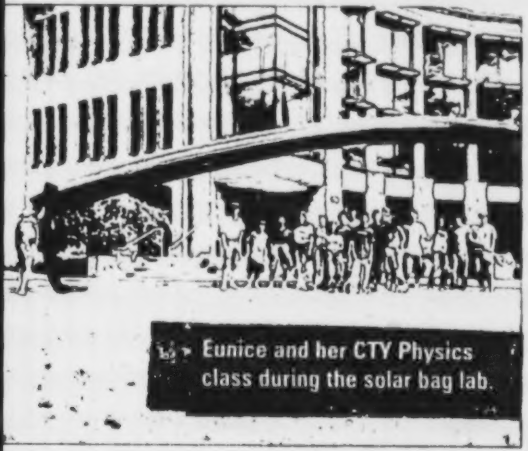
Each NASA center administers its own educational programs. To review an index of educational programs in all NASA centers, visit http://ehb2.gsfc.nasa.gov/edcats/2000/nep/programs/index.html (Click on Student Support Programs, K–12; or use the search function at the bottom of the page).

PHYSICS, CTY Style

by Eunice Kim

When I first walked into the CTY Fast-Paced Physics classroom, I thought of blackboards filled with equations, people in white lab coats, Albert Einstein's $E=mc^2$, and my friends' comments about how difficult the class is. But three weeks later, I left that classroom with an ability to see physics at work in events as diverse as the forces holding up streetlights and the gravitational force at work on everything on this earth.

Of course, there were tons of equations and constants to memorize, but that was to give us a solid base for the real heart of the class: understanding awesome concepts such as forces, motion, momentum, energy, light, sound, and magnetic fields. Both my teacher, Brian Hastings, and his assistant, Jaime Maskell, were extremely experienced in the field and helped me and my classmates open our minds to the fascinating role of physics in the world around us.


Eunice and her CTY Physics class during the solar bag lab.

The course consisted mainly of lectures and lab work. One of the best labs was the solar bag lab. Mr. Hastings took our whole class outside into a field and then asked us to help him open up the solar bag. It resembled a black garbage bag, except that it was over 20 feet long. He then told us to fill the bag with air. We were all contemplating how to do this when one of my classmates suggested borrowing a leaf-blower from a nearby lawn caretaker. The leaf-blower filled the solar bag with air in a matter of seconds, and then we tied the open end shut.

While we held onto the tied end, my teacher explained that we would all soon witness the amazing energy of the sun. Soon, the other end of the bag began to rise, higher and higher with every second, until the whole solar bag was practically perpendicular to the ground! Soon enough we all figured out how the solar bag had risen. Since the bag was black, it absorbed the sun's heat energy quickly, which soon transferred to the air molecules inside. The air molecules were moving so fast and bouncing off each other at such high speeds that they spread farther and farther apart. When the air inside the solar bag became less dense than the air outside, the bag began to rise.

In other labs, we investigated Hooke's Law, centripetal motion, projectile motion, laws of heat exchange, conservation of linear momentum, gravitational acceleration, thermal equilibrium, and, my favorite, the bending of light waves. We were actually able to trace the path of the light rays on paper using a thick block of glass. We even learned how polarized lenses of sunglasses work.

Yes, the course was extremely demanding and fast-paced, but after the first grueling day of class, we all adjusted to the pace. I soon realized that I was becoming more interested in physics as the class progressed.

CTY Physics gave me insight into a field that I didn't know much about before. I learned that physics is a lot more than a handful of formulas. The real value is in applying them to everyday life. As Albert Einstein once said, "In the matter of physics, the first lessons should contain nothing but what is experimental and interesting to see. A pretty experiment is in itself more valuable than twenty formulae extracted from our minds." The CTY Physics class seemed to put that quote into action. Even if physics isn't your favorite subject, you could get a lot from this course that teaches everyone how to love it. ■

Eunice Kim is a 10th grader at Phillips Academy Andover, where her favorite subject is math. She enjoys playing the piano, tennis, crew, track, and singing.

PHYSICS & ASTRONOMY AT CTY

The Center for Talented Youth offers a range of courses in mathematics, science, and the humanities for qualifying students. In addition to Fast-Paced High School Physics, aspiring physicists and astronomers might also consider the CTY Astronomy course or the CAA Introduction to Astronomy course, both of which expose students to the physics and mathematical concepts of astronomy. All CTY courses are three weeks long. For more information: *CTY Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277; www.jhu.edu/gifted/ctysummer*

OTHER SUMMER PROGRAMS IN PHYSICS and ASTRONOMY

Aerospace Summer Camp

This residential, three and one-half week camp is for students ages 15–18. The program fosters a basic understanding of space and space technology through hands-on activities and labs, classroom interaction, guest speakers from the aerospace community, and field trips. College credit available. *Aerospace Summer Camp, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Boulevard, Daytona Beach, FL 32114-3900; (800) 359-4550; summer@cts.db.erau.edu; www.ec.erau.edu/dce/summer/aerospace.html*

Astrocamp

This residential camp for students ages 8–15 is offered by Guided Discoveries, a non-profit outdoor educational organization. Students explore astronomy, rocketry, electricity, solar studies, the GPS satellite system, microgravity and gyrotech, meteorites, geology, microfossils, and magnetism in either a one-week camp (ages 8–14) or in a two-week camp (ages 10–15). *Guided Discoveries, 26800 Saunders Meadow Road, Idyllwild, CA 92549-3399; (909) 659-6062; jkarp@guideddiscoveries.org; www.guideddiscoveries.org/astrosit/ astrofro.htm*

Astronomy Camp

The Oregon Museum of Science and Industry offers this residential, weeklong astronomy camp for students ages 12–16. Participants spend their evenings studying the skies and their days learning more about constellations, nebulae, galaxies, telescopes, star charts, space flight, as well as exploring the geology and ecology of canyons surrounding Hancock Field Station. *Oregon Museum of Science and Industry, 1945 SE Water Avenue, Portland, OR 97214-3354; (503) 797-4662; registrar@omsi.edu; www.omsi.edu/education/camps/1418.cfm*

Astronomy Camp

The University of Arizona offers this residential, weeklong astronomy camp for students ages 13–19 (there is both a beginning camp and an advanced camp). Campers operate research telescopes, interact with leading scientists, and interpret their own observations. Each student completes a research project on either astronomical photography, spectroscopy, electronic photometry, or CCD imaging. *Dr. Don McCarthy, Steward Observatory, The University of Arizona, 933 North Cherry Avenue, Tucson, AZ 85721-0065; (520) 621-4079; dmccarthy@as.arizona.edu; http://ethel.as.arizona.edu/astro_camp/*

Hillsdale College Summer Science Camps

The Chemistry and Physics Camp is an intensive, residential, weeklong camp for students in grades 10–12. Students learn hands-on about chemical dyes, chromatography, spectroscopy, polymers, holography, superconductivity, X-ray diffraction, and thermodynamics. Students can earn college credit upon passing the final exam. Participants are selected primarily from the local Michigan and surrounding tri-state area, but students nationwide are encouraged to apply. *Summer Science Camps, c/o Dr. Francis X. Steiner, Biology Department, Hillsdale College, Hillsdale, MI 49242; (517) 437-7341 x 2399; fxs@ac.hillsdale.edu; www.hillsdale.edu/academics/compsci/ScienceCamp/brochure.html*

Penn Summer Science Academy (PSSA)

PSSA is an intensive, four-week, non-credit program consisting of guided laboratory projects, seminars, faculty lectures, discussion groups, problem-solving sessions, and field trips, all taught by Penn scientists and students. Students ages 16 and 17 choose a concentration in either Molecular Biology or Physics & Astronomy. Most PSSA students choose to live on campus, but local residents may commute. *Summer Youth Programs, University of Pennsylvania, 3440 Market Street, Suite 100, Philadelphia, PA 19104-3335; (215) 898-5716; summer@sas.upenn.edu; www.sas.upenn.edu/CGS/highschool/pssa.shtml*

Rocky Mountain Astronomy Camp

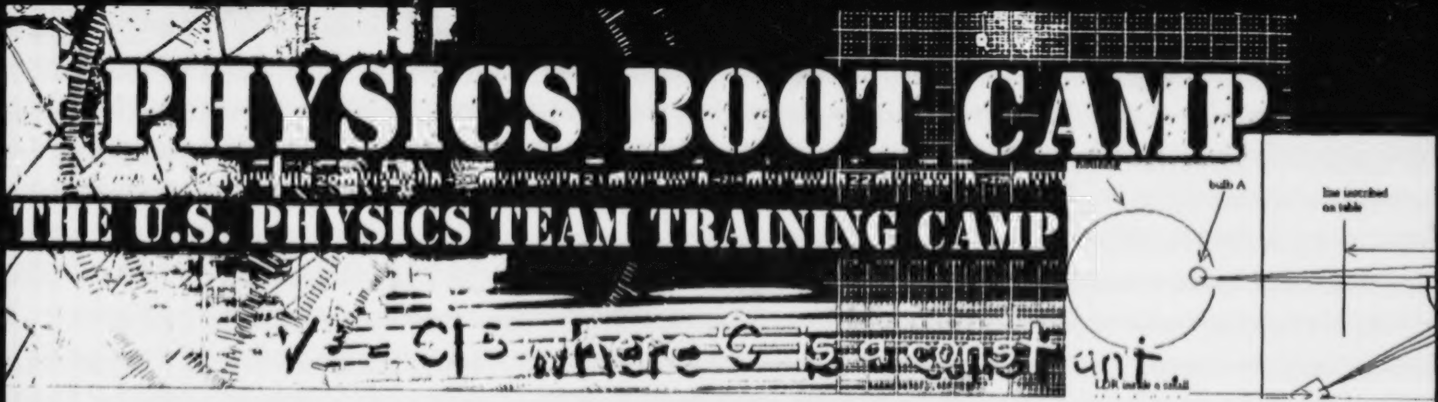
In this residential, weeklong camp, students in grades 10 and 11 study planets, stars, galaxies, and black holes. Particular attention is given to the techniques and instruments used to study the universe. Students may also take part in research that could carry on to projects for school credit or science fairs. *Pikes Peak Observatory, 143 W. Dartmouth Avenue, Englewood, CO 80110; jessica.reynolds@pikespeakobservatory.org; www.pikespeakobservatory.org/education/rmac.htm*

Summer Science Program (SSP)

The six-week, residential SSP is a challenging experience that uses astronomy and space science to awaken and strengthen connections to all of science. The program exposes rising 11th and 12th graders to advanced topics in mathematics, physics, astronomy, and computer science. Working in teams of three, participants determine the orbit of a minor planet using their own telescope observations, related lab work, and calculations. *Summer Science Program, Inc., 9198 Skyline Boulevard, Oakland, CA 94611-1748; (510) 333-2112; info@summerscience.org; www.summerscience.org*

PHYSICS BOOT CAMP

THE U.S. PHYSICS TEAM TRAINING CAMP



by Ben Schwartz

Just making it to the U.S. Physics Team Training Camp is not easy. The process starts with the Physics Olympiad Screening Exam, taken by about 1,100 students nationwide. The top 200 scorers are invited back to take the second round Semi-Final Exam, a three-hour free-response test. It was unquestionably the hardest test I had ever taken. I walked out of the room at the end and told my physics teacher, "Maybe next year." I was suitably surprised when, a few weeks later, I got a phone call telling me that I'd made the top 24 and was invited to come to the U.S. Physics Team Training Camp.

The U.S. Physics Team Training Camp is fun in about the same way that military boot camp is fun; in fact, it's affectionately known as "physics boot camp." I'm not saying it wasn't enjoyable; this year, I'm trying out for the team again because I'd love to go back. There we learned a lot of physics rarely taught in high school, heard lectures by Nobel-prize-winning researchers about their work, had discussions about topics ranging from the uses of Fourier analysis to the virtues of a truly unregulated market, and played a lot of card games (especially Mafia). We even had breakfast with our senators and representatives. But mostly, we took tests.

Almost every day, there was a test, usually a two-hour test with two free-response problems. Scores are never given out, so at one time or another almost everyone feels that they're 24th (although, as our Academic Director, Mary Mogge, pointed out, being 24th in the country isn't a bad worst-case scenario). There is also a two-hour lab almost every day, starting with the practice labs (like using a pendulum to measure the acceleration due to gravity) and ending with the Mystery Labs. I won't divulge any secrets, but they're hard, and they don't come with directions. The Final Exam, a five-hour test with three questions, beat the Semi-Final Exam as unquestionably the hardest test I have ever taken, ever. The fact that I found it so hard may have had something to do with why I wasn't selected as one of the five team members who went to the IPhO to represent the U.S.

I urge you to take the preliminary test, even if you don't think you're qualified for the team. The first year I took it, I did not do well, but it still gave me interesting problems to think about. No matter how far you go with the U.S. Physics Team, you will confront challenging, intriguing questions. And occasionally, you will prevail. ■

A senior at Staples High School in Westport, CT, ***Ben Schwartz*** enjoys computer programming, playing the tuba, math team, *a capella* singing, and recreational physics problems. At some point, he hopes to do something and not find out later that he's not the first to have done it.

The International Physics Olympiad

The International Physics Olympiad (IPhO) was first held in 1967 and included only Soviet bloc countries until the 1980s. The U.S. began participating in 1986. This past summer, at the 32nd IPhO, held in Antalya, Turkey, the U.S. team tied Russia for second place. Three U.S. team members (Andrew Lutomirski of Los Angeles, CA; Willie Wong of Short Hills, NJ; and Brian Beck of Beachwood, OH) won gold medals and the other two team members (Daniel Peng of Colts Neck, NJ; and Vladimir Novakovski of Springfield, VA) won silver medals.

To learn more about the International Physics Olympiad, see www.jyu.fi/tdk/kastdk/olympiads/

To obtain an application for the Physics Olympiad Screening Exam, contact Annette Coleman at the American Association of Physics Teachers Programs Office at (301) 209-3344 or acoleman@aapt.org

Because of the events of September 11, the U.S. will not send a team to the 2002 IPhO, scheduled to be held in Jakarta, Indonesia. Instead, the AAPT will host a summer institute and will award scholarships to the top students at the 2002 U.S. Physics Olympiad Summer Camp. For details, see http://oliver.aapt.org/programs/olympiad/

Power!

by Jim Reardon, Ph.D.

You need power. When you're shivering in the cold of winter, you want heat. When you're melting in the heat of summer, you want air conditioning. I won't even mention all the lights, TVs, and computers you use every day. Everyone needs power, and as there are more and more people in the world, more and more power is needed. It's increasingly difficult to give people the power they want.

At the MIT Plasma Science and Fusion Center, high school student Areej Pirzada uses a hand held magnet to "bend" a plasma.

Photo by Paul Rivenberg courtesy of the MIT PSFC

When we look around at the natural world for a solution, the first thing we notice that gives off a lot of power (in the form of light and heat) is the sun. So some scientists, like me, are trying to figure out how to generate power here on Earth the same way the sun generates power.

A Giant Ball of Energy

The sun is a giant ball of plasma, or a giant ball of ionized gas. Anything can be made into a plasma if you heat it enough. If you were to drop an aluminum soda can onto the sun, first it would melt (pass from solid to liquid), then it would vaporize (pass from liquid to gas), and finally, when the electrons began to break free from their atoms, it would become an aluminum plasma. Plasma is sometimes called "the fourth state of matter," after solid, liquid, and gas. The sun is a hydrogen plasma.

Deep within the core of the sun, nuclei of hydrogen are smashed together to form helium nuclei. Each helium nucleus is slightly less massive than the four hydrogen nuclei from which it is created. The lost mass m is converted into energy E, as described by Einstein's famous formula $E=mc^2$, where c is the speed of light (about 300,000 km/sec). Since c is very large, a lot of energy can be made from just a little bit of mass.

The energy liberated by this process of nuclear fusion keeps the sun hot. But the hydrogen nuclei can't be convinced to fuse in large quantities unless they are very hot to begin with. The temperature at the center of the sun, where nuclear fusion happens, is thought to be about 16 million degrees Celsius. That's pretty hot! How can you hold something that hot in the laboratory?

Nuclear Fusion on Earth

Nature gives us one answer: magnetic fields. Plasmas respond to magnetic fields. If you've ever played with a magnet, you know that magnetism can move things around without touching them. Scientists have found out how to hold hot plasmas motionless without touching anything, using magnetic fields.

Right now the world record for fusion power is held by an experiment called the Joint European Torus, or JET, in England. In 1997, scientists there created a plasma that, for a fraction of a second, generated more than half as much power from fusion as was required to heat it and hold it in space.

But they ran into a difficulty observed by the famous physicist Richard Feynman: holding a plasma in space using magnetic fields is rather like trying to hold jello in place using rubber bands. The plasma is always jiggling and quivering and trying to escape. A sophisticated computer system is needed to monitor the plasma location. Then, if the plasma tries to escape in one direction, the magnetic field can be quickly adjusted, pushing the plasma back into place.

If the government continues to fund fusion research, it seems inevitable that in the next generation—your generation—a fusion device will be built that generates more power than it consumes. So if you're interested in math and science, like challenges, and would like to devote your life to a project that might someday benefit all mankind, then you might consider a career in nuclear fusion. ■

Jim Reardon participated in the Johns Hopkins program for the gifted and talented 20 years ago. He went on to earn his Ph.D. in Plasma Physics at MIT, and is currently measuring ion temperatures of thermonuclear plasmas at the University of Wisconsin—Madison. This summer he taught Etymologies at CTY's summer program at Union College in Schenectady, NY. For fun he runs and records music.

Related Web Sites

Princeton Plasma Physics Lab
www.pppl.gov

General Atomics
www.gat.com

MIT Plasma Science and Fusion Center
www.psfc.mit.edu

In Search of Distant Planets

by Marshall Perrin

The search for distant worlds has been a staple of science fiction stories since the dawn of the genre. Who hasn't read or watched as bold explorers travel the void "to explore new worlds and seek out new life," to quote the famous Captain Kirk? Central to this vision has been the idea that the way to discover new worlds around distant stars is by someday traveling there in person. Yet today, scientists around the world are already discovering worlds around other stars, worlds by the dozen, which are gradually yielding their secrets to us.

I am a graduate student in astrophysics at UC Berkeley, home of one of the most successful planet searches presently underway. It's a tremendously exciting time to be starting a career in this field, as questions first asked millennia ago are finally being answered. The tools for finding these new worlds are telescopes and computers, not spaceships, and the discoveries being made today are changing the way we understand our own place in this universe.

Wobble, Wobble Little Star

We can see the planets in our own solar system by reflected sunlight, but only at night when the sun's glare does not obscure them. If we try looking directly for planets around other stars, we find the planets' reflected light is millions of times fainter than their parent stars. Lost in the glare, we must find some other way to detect them.

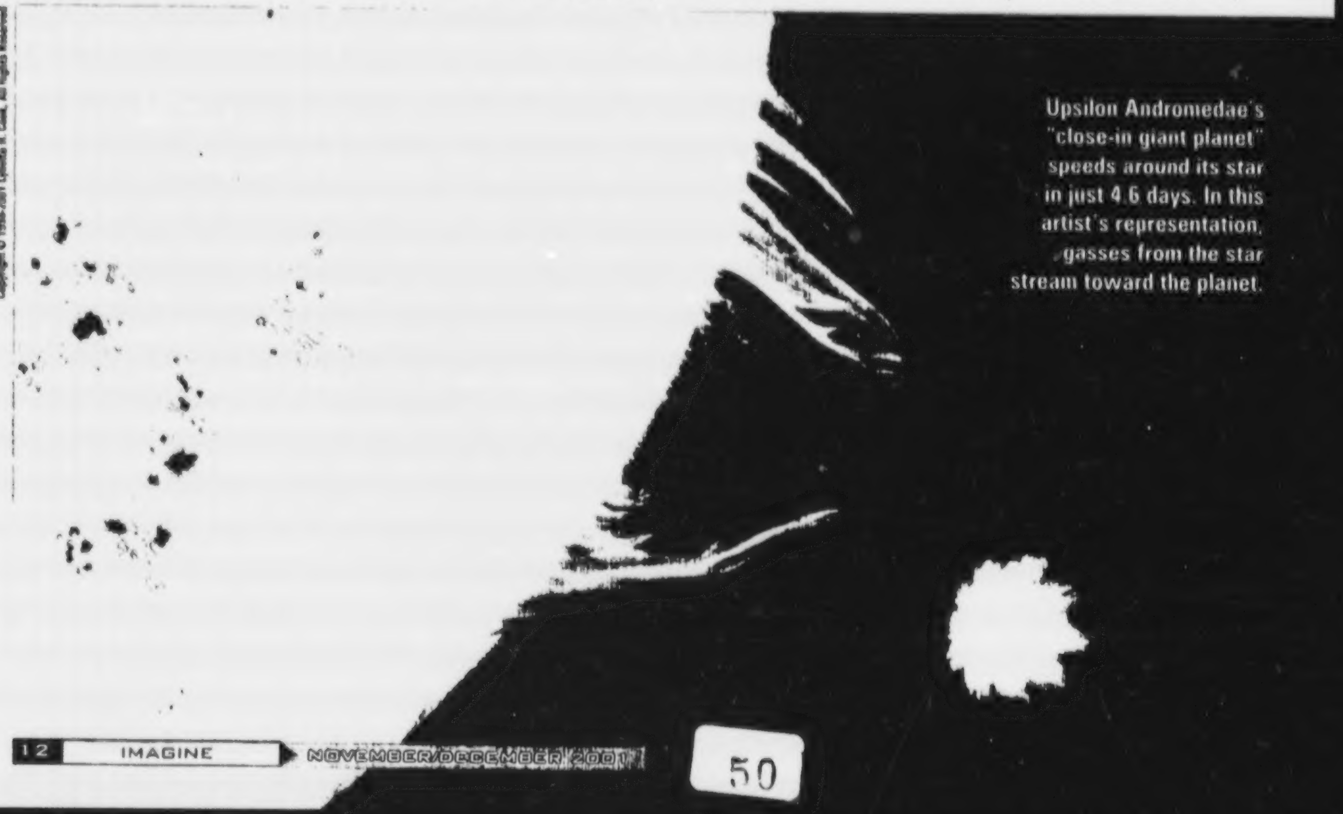
In the early 1990s, several groups of astronomers came to the same realization. As a planet orbits a star, its gravitational pull tugs on the star and causes it to "wobble" back and forth slightly. Astronomers hoped that painstaking observations, using some of the world's largest telescopes, might detect planets not by reflected light, but by the wobble of the stars they orbit. In theory, careful measurements could reveal the masses, distances from the star, and orbital periods of planets we cannot see directly.

Planets Unexpected

Only in the past decade have astronomical detectors reached the precision necessary for making the necessary observations and computers reached the speeds and power needed for analyzing the data. Two major teams, one led by Michel Mayor and Didier Queloz in Switzerland, and one led by Geoff Marcy here in California, set out to attempt these observations of stellar radial velocities.

The easiest planets to detect by this method are massive ones, like Jupiter and Saturn in our own solar system, which exert a strong gravitational pull on their star. These two planets move in slow, stately orbits, taking decades to swing once around the sun. Everyone expected the radial velocity observations to take similarly long periods of time to record slow wobbles of distant stars. It thus stunned the world in 1995 when Mayor and Queloz reported a planet much larger than Jupiter which orbited not once every four decades, but once every four *days*.

In the years since, Marcy's team here at Berkeley has led the way in discovering dozens more such "close-in giant planets," as they came to be called. Perhaps even more surprisingly, planets that orbit further out and more slowly were eventually discovered, but they were found to have very elliptical orbits. Planets four or five times larger than Jupiter were found in orbits more like that of a comet than the nearly circular orbits in our own solar system. Some of these planets are real monsters,



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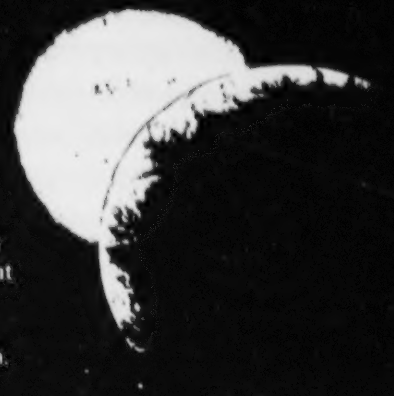
Upsilon Andromedae's "close-in giant planet" speeds around its star in just 4.6 days. In this artist's representation, gasses from the star stream toward the planet.



D195019's giant planet as a mass 3.5 times that f Jupiter, but resides loser to its star than lercury does to the Sun. s orbital transit time: 8.3 days.

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too, weighing in at an astonishing ten or fifteen times the weight of Jupiter!

Understanding These New Worlds

These discoveries posed a serious challenge for those seeking to understand planetary systems–no one ever expected worlds like these! Planets are thought to form from a disk of gas and dust swirling around an infant star. Astronomers believed that giant planets could only form far from a star, like the giant planets in our own solar system. Closer in, higher temperatures prevented most ices and gases in the disk from condensing, resulting in small, rocky planets like Earth and Mars. Planet formation should proceed in an orderly fashion, resulting in the tidy, circular orbits of our own solar system–or so we thought.

The picture that has emerged from the study of extrasolar planets is a far more complex one. Baby planets exert gravitational forces on the "circumstellar disks" of gas and dust around a young star, perhaps creating spiral density waves like those familiar in spiral galaxies. These waves can push planets around, in effect forcing them into highly eccentric orbits. Tidal drag forces from the disk can make giant planets that formed at great distances from a star migrate inward until they skim barely above the sun's surface in four-day orbits. In some cases, planets may even migrate so close as to be swallowed whole by their parent star! Planets can interact with each other, too: Close encounters and indeed direct collisions between massive worlds can change their orbits drastically, creating eccentric orbits or sometimes tossing one out of the system entirely.

The processes at work in infant solar systems are many, and our current understanding of them is only at the roughest of levels. There's truth to the old saying that every answer we obtain raises two new questions, but tremendous progress is being made all the time by scientists and students working around the globe.

Moving Forward

This revolution in planetary astronomy continues to be driven forward by technology. Today, we can detect only the largest planets; the wobbles induced by smaller ones are just too hard to see. But techniques are rapidly improving. Astronomy today is one of the most computerized of all the sciences; long gone are the days of the noble observer with his eye pressed to the back of a gleaming glass and chrome telescope peering at the heavens. Today that astronomer is much more likely to be found sitting in front of a computer, controlling electronic instruments with far greater sensitivity than the human eye (and much greater patience during long winter nights, too!).

An increasing number of observations are carried out with space-based instruments as well, although general-purpose telescopes like the Hubble Space Telescope aren't that well suited to the task of planet hunting. Rather, a number of dedicated missions are planned for coming decades, with names like the Space Interferometry Mission, Terrestrial Planet Finder, and ultimately perhaps the Terrestrial Planet Imager.

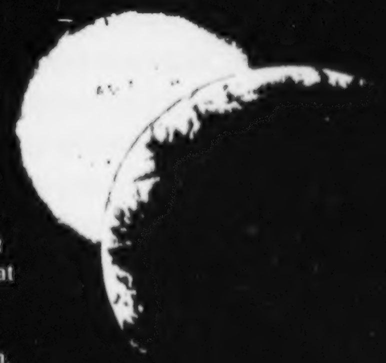
Some of these missions will try new methods for detecting planets instead of the tried-and-true radial velocity wobble, in the hopes of seeing different types of planet. For instance, one proposed mission, called Kepler, would monitor a hundred thousand stars continuously for five years, looking for rare eclipses of stars by Earth-sized planets. Meanwhile, more advanced ground-based telescopes will surely continue to find planets by tracking the wobbles of stars. In addition, now that we know for sure that planets are out there, some astronomers are starting to think harder about that problem of directly imaging a planet in reflected light amidst the glare of a star a million times brighter. This is where I myself am working, as part of a team using specialized techniques called adaptive optics and coronography to try to image the companions to distant stars. It's a challenging proposition, but the potential payoff is immense.

There's No Place Like Home?

This past August, Dr. Marcy's team announced a long-awaited discovery: a solar system that looks a lot like our own, at last. With five dozen planetary systems found so far that look nothing like ours, astronomers were starting to wonder if our solar system was one of a kind. But Marcy and his team discovered evidence for two planets orbiting a star in the Big Dipper named 47 Ursa Majoris, two worlds moving in nice circular orbits and sized similarly to Jupiter and Saturn. But each answer begets more questions: Are there also small rocky worlds we cannot yet detect in that system? How common are Earth-like planets? Ultimately, do any harbor life, even intelligent life? The chances are greater than ever that these questions will be answered, at least in part, within our lifetimes. Maybe they'll even be answered by some of you! ■

Marshall Perrin **started gazing at the stars while growing up outside of Annapolis, MD. A CTY alumnus, he graduated from Harvard University in June 2000 and is now a graduate student in astrophysics at UC Berkeley.**

For more information, see the UC Planet Search Project home page: http://exoplanets.org/



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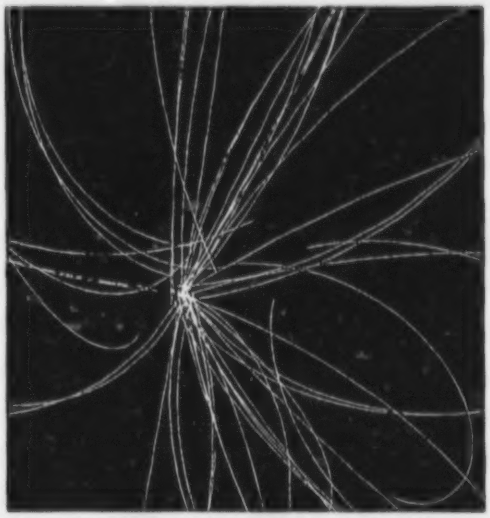
Charmed

A Life in Particle Physics

by Melissa Franklin, Ph.D.

When I was fifteen, I had every intention of becoming a novelist, a filmmaker, or a philosopher. Then one day, quite by accident, I read a small book about quantum mechanics, describing in detail the atom, and it caught me. It was visual, with pictures of electrons waving about the nucleus. It was narrative, describing attractions and repulsions. And it was as philosophical as could be: were these particles or waves? At first I found physics quite difficult. I didn't really understand the story. Later, it was still difficult, but by then I was hooked.



As protons and antiprotons collide in Fermilab's Tevatron accelerator, they *annihilate and form* new particles. This image shows the tracks of particles emerging from the collision point.

In the fall of my second year at university, the theoretical physicist Murray Gell-Mann came to lecture. A decade earlier, he had proposed the existence of quarks—a class of subatomic particles that are among the fundamental constituents of matter—but for ten years, no one had detected one. Coincidentally, he spoke to us on the day that the discovery of the "charmed" quark was announced. By the time he finished telling us about the discovery and his interpretation of it, our brains were on fire. It was the first time people started to believe that quarks really exist.

That summer, some of my professors were going to work at the Fermi National Accelerator Laboratory in Batavia, Illinois. Fermilab was one of the few places in the world where charmed quarks might be generated and detected, and I asked if I could come. They couldn't pay me, but I didn't care. I just wanted to be there. I spent the summer working on an experiment to produce a charmed quark. The particle detector ran 24 hours a day. I often worked the night shift, stepping outside in the morning just as the sun rose over the horizon. The conjunction of our experiment, looking for the smallest elements of nature, and the huge morning prairie sky was perfect.

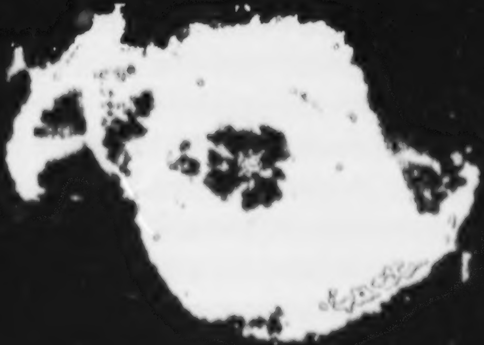
When I graduated from college, I went to CERN, the European accelerator center in Geneva. There I worked for Leon Lederman, who that summer with his team at Fermilab discovered the fifth quark, the "bottom" quark. After completing graduate work at Stanford, I returned to Fermilab to look for the sixth and last quark, the "top" quark, which we finally detected in 1995. We are still studying this quark today, as well as looking for new particles and perhaps new dimensions.

I still spend my summers at Fermilab. There, we work at the energy frontier, colliding particles at higher energies than anyone else in the world right now, trying to generate subatomic particles that last only a few nanoseconds before decaying into more mundane particles. The faster the accelerator, the more massive the particles that can be generated, and the more rare the events that can be observed. But even using the most powerful accelerator on the planet, the interactions we're looking for are still extremely infrequent. In our last experiment, we collected data for five years and came up with only a handful of "candidate events" or possible sightings.

Today, many particle physicists, including me, are becoming interested in particle astrophysics. Ninety percent of the estimated mass of the universe is still unaccounted for by luminous bodies like stars. Particle physicists may identify components of the missing "dark matter" and help figure out what's going on. The top quark turned out to be extremely heavy for a fundamental particle—almost the mass of a gold atom and 20,000 times heavier than the common "up" and "down" quarks that make up protons and neutrons. And even heavier subatomic particles may yet be found if we can build fast enough accelerators. Interestingly, while theoretical physicists can predict that certain classes of subatomic particles *should* exist, they cannot predict how heavy the particles will be. That's something we can only determine experimentally. As we learn about the subatomic world, we may answer questions about what the universe is made of and how it all began—questions worthy of someone who once wanted to be a philosopher! ■

A physics professor at Harvard University, ***Dr. Melissa Franklin*** enjoys figuring out what piece of the universe she wants to measure next.

For further exploration, see Fermilab's Inquiring Minds site: *www.fnal.gov/pub/inquiring/*



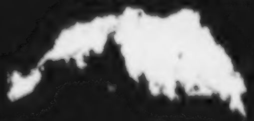
The Cat's Eye Nebula, 1994
3,000 light years away, in the constellation Draco, a dying star is surrounded by jets and shells of gas. These clouds of gas were named "planetary nebula" because they resembled planets when observed through ground-based telescopes. Although Hubble's view is more accurate, the name stuck.

Photo: NASA

When the Hubble Space Telescope was released into orbit on April 25, 1990, our view of the universe was about to be changed forever. In the years since, we have *oohed* and *aahed* at images of celestial objects and events we could barely imagine before: newborn and exploding stars, colliding galaxies, planetary systems millions of light years away.

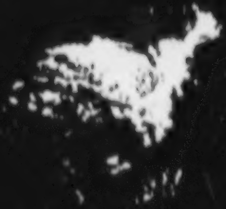
The photos on these pages span the years 1994 through 2001. They are among the most vivid and startling glimpses into the universe we could find. We include them here as a tribute to what Hubble has already accomplished— and in anticipation of the amazing discoveries it has yet to make.

Seeing



Stellar Incubator, 1995
At the top of this swirl of molecular hydrogen gas, embryonic stars are forming in protrusions called EGGs—Evaporating Gaseous Globules. The EGGs might look small, but each one is actually larger than our solar system.

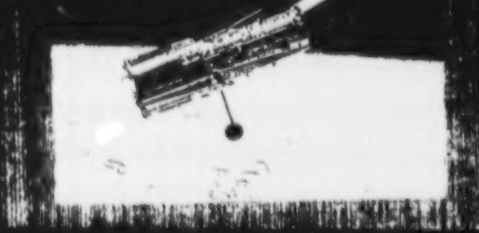
Photo: NASA



Eta Carinae, 1996
This star, which is about 100 time more massive than the Sun, seems to have undergone a supernova explosion about 150 years ago. But it survived the explosion, making it one of Hubble's more enigmatic finds.

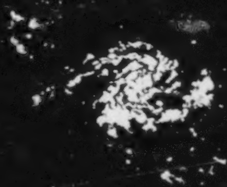
Photo: Jon Morse and NASA

Did You Know?



- Edwin Powell Hubble thought he wanted to be a lawyer. But after passing the bar exam, he realized that astronomy was his true love. His discoveries, including that the universe is expanding, remain milestones in the history of astronomy.
- Twenty years of research went into the Hubble Space Telescope (HST). After 20 years of service, in 2010, HST will be replaced by the Next Generation Space Telescope.
- HST orbits the Earth in just 97 minutes, traveling at 5 miles per second. It orbits about 380 miles above Earth's surface, just outside our planet's atmosphere.
- HST is as large as a school bus and weighs 12 tons.

Stars



Galactic Silhouettes, 2000

140 million light years from Earth, the alignment of this galaxy pair—one face-on, the other behind it—allows us to see otherwise invisible dark material in the front galaxy.

Photo: NASA and STScI/AURA

Warped Galaxy, 2001

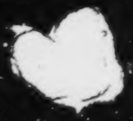
A collision and subsequent merging with another galaxy has resulted in an unusual twist in the structure of this galaxy. Millions of years from now, after the shock of collision has worn off, this galaxy will appear as a flat, single galaxy.

Photo: NASA and STScI/AURA

Supernova 1987A in the Large Magellanic Cloud, 1999

This star underwent a supernova explosion about 12 million years ago. Hubble shows what remains: the supernova remnant surrounded by rings of matter, all against a backdrop of massive stars and filmy clouds of gas.

Photo: NASA



Galaxy Collision, 1997:

What might happen when our galaxy collides with the neighboring Andromeda galaxy billions of years from now? This photo gives a clue. At the heart of the collision, 1,000 star clusters spark to life.

Photo: NASA and STScI

Sagittarius Star Cloud, 1998

This region at the center of our galaxy contains stars of all ages, revealed by their color: blue stars are the hottest and youngest, while the "red giants" are cooler and near the end of their lives.

Photo: NASA and STScI

Be sure to visit http://oposite.stsci.edu, http://heritage.stsci.edu, and http://grin.hq.nasa.gov for many more awe-inspiring Hubble photos.

SINES AND WONDERS

The Science of Sound

by Carol Blackburn

If a tree falls in a forest and no one is there to hear it, *does* it make a sound?

This classic conundrum arises because we use the word "sound" to refer to two different things: (1) sound waves, and (2) the sensations our ears hear. The first is straight physics, while the second is a biological system's interpretation of physical phenomena.

The science of sound begins with the physics of waves, then—like a wave—radiates out to include sensory biology, the applied physics of musical instruments, and acoustics. Here we take a few steps into this vast and intriguing terrain, and suggest some paths to pursue on your own.

Fundamentals

Sound is a pressure wave produced by a vibrating object. Like a pebble dropped in a pond, each vibration pushes the surrounding medium, creating a small compression that propagates, spreading away from the source of the vibration. Unlike light waves, which can travel in a vacuum, sound waves require a medium. Ridley Scott was right: in space, no one can hear you scream.

Most objects have a *natural frequency* or set of frequencies at which they vibrate. The natural frequency depends on several factors. One is length: a long violin string vibrates at a lower natural frequency than does a short one. Another is mass: a light string can move more quickly than a heavy one, and so vibrates at a higher frequency. A third is "springiness": a taut violin string springs back more quickly than a loose one, and so vibrates at a higher frequency.

We hear vibrational frequency as *pitch*: a low-frequency vibration has a low pitch, and a high-frequency one has a high one. The frequency of a sound wave is expressed in cycles per second or hertz (Hz): a 5 Hz wave would pass a given spot 5 times per second. The other important attribute of a sound wave is amplitude, which refers to the magnitude of the movements produced. We hear amplitude as loudness.

For simple waves, a simple drawing of a sinusoid shows us the frequency and amplitude. But most sound waves are not simple, and a picture of the waveform itself does not provide details of what the wave is made up of. A better way to visualize the content of a sound wave is to graph frequency on the x-axis and the energy in the sound wave at that frequency on the y-axis. Such a graph is called a *vibrational spectrum*. A pure sine wave has the simplest vibrational spectrum, with all its energy at a single frequency (Figure 1A). Another simple spectrum is that of noise, which has similar amounts of energy at all frequencies. ("White noise" was so named in analogy to "white light," which contains all frequencies of visible light in roughly equal amounts.)

Other sounds have complex spectra, with mounds, peaks, and valleys. Spectra with prominent peaks or mounds have a pitch. Thunder has very broad peaks in its spectrum and has an indistinct pitch, while a note sung by a bird has fairly strong peaks in its spectrum and has a distinct pitch. Most sounds with a clear pitch are produced by living creatures, which may be why auditory systems evolved to perceive them with as much sophistication as they do.

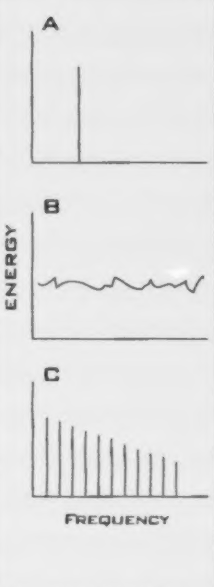


Figure 1. Vibrational spectra of (a) a sine wave, (b) noise, (c) a musical tone (idealized depiction)

Harmonics

Some objects vibrate in mathmatically simple ways. A tuning fork vibrates predominantly at a single frequency and produces a very pure tone. Other things vibrate in more complex ways, moving in more than one pattern or *mode* at the same time. A vibrating string, for example, vibrates as a whole, at what is called the *fundamental frequency*. But it also vibrates in two equal parts, and in three, and in four (Figure 2). Vibrational modes that are integer multiples of the fundamental frequency are called *harmonics*. A vibrating string manages to move in many modes simultaneously, but we don't hear each mode as a separate note, as in a chord. Rather, the pattern of harmonics creates the tone's "color" or *timbre*. We hear a rich sound whose pitch is the fundamental frequency.

While we don't normally hear harmonics, we can force them to reveal themselves on an acoustic guitar. Pluck a string, then touch it lightly at its midpoint (just above the 12th fret). If you touch just the right spot, you'll silence the original tone, but you'll still hear a tone an octave above the original. You haven't plucked the string again; this octave-higher tone was there all along. By touching the string, you've stopped its vibration at its fundamental frequency, but not at modes that have a node at the string's midpoint, like the second harmonic. That's what you're hearing now. You can hear the third and fourth harmonics by touching the string at one-third (just above the 7th fret) or one-fourth (just above the 5th fret) its length.

Of course, a stringed instrument is more than just a vibrating string. If you've ever plucked a string on an electric guitar that is not plugged in, you know how little sound it makes. Stringed instruments depend almost entirely on the sympathetic vibrations of the instrument's body to amplify and project their sound. And the body has natural resonant frequencies of its own. This means that it will do a better job of resonating with and amplifying some frequencies than others, and will color some frequencies differently than others. An instrument's sound is a combination of the resonant properties of its sound generator (the string) and sound amplifier (the body).

Musical Intervals

Did you know that your auditory system can hear fractions? The musical intervals used in Western music are close to whole-number fractions, and most people can easily identify them. The third note of "Taps," for example, has a frequency 4/3 that of the first note, and the sixth note has a frequency 5/3 that of the first. This remarkable ability has no counterpart in our other senses—you wouldn't be able to identify which hue had a frequency exactly 4/3 that of a reference color.

The mathematical dimension of musical sound has fascinated people at least as far back as Pythagorus. A single musical note can include many harmonics—a ladder of mathematically related frequencies. Is it any wonder that humans used those natural ladders to build upon? Musical scales (from *scala*, Latin for ladder or stairs) are based on intervals—steps—that occur naturally in musical tones.

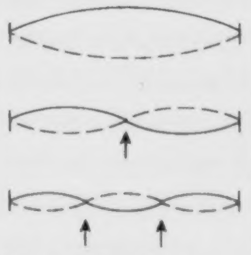


Figure 2. First three vibrational modes of a vibrating string. Arrows indicate nodes.

Since harmonics are "built in" to musical tones, have all cultures come up with the same musical scales? No, but in the majority of cultures, the similarities are remarkable. When archaeologists recently made playable replicas of flutes found in Pharaohs' tombs, the flutes produced much the same scale we use today!

The most basic division in "musical space" is the octave, which occurs whenever the frequencies of two notes differ by a factor of two (or four or eight or one-half). Since 2:1 is such a simple ratio, it's not surprising that the octave would be a basic musical building block. What is surprising, and unlike anything our other senses do, is that we hear notes an octave apart as "the same" in some fundamental way. Middle C and high C are both Cs; one is just higher than the other. We don't question that; it's obvious. But think how peculiar that is. We don't see light that has twice the frequency of red light as "high red" light; we see it as its own color, violet. We don't feel a doubly fast mechanical vibration as the same as the original; we feel it as a faster vibration. We perceive pitch as continually increasing—high C is clearly higher than middle C—but in some fundamental way, it also moves in circles, coming back to C again and again and again. Musical space is not linear; it's like an ever-ascending spiral, or a multi-story building, with every loop or story having a full scale of its own. No one knows why doubled frequencies sound the same to us. But if our auditory system did not work this way, Western music, with its harmonies that cross many octaves, could never have developed.

Next time you listen to music, don't just appreciate the composer's creativity and the performers' artistry. Take a moment to contemplate the complex waves swirling about your head. Consider the many mathematical relationships that exist in every moment of music—and the millennia of evolution that went into creating an auditory system capable of decoding those patterns. Think of the thousands of years of experimenting with reeds, pipes, gourds, and cat guts that produced the magnificent instruments of today. And wonder. ■

This article is online with additional links at: www.jhu.edu/gifted/imagine/sines.htm

Resources for Further Exploration

Web sites

Acoustics and Vibrations Animations. Skip the technical text—just enjoy the great animations! www.kettering.edu/~drussell/demos.html

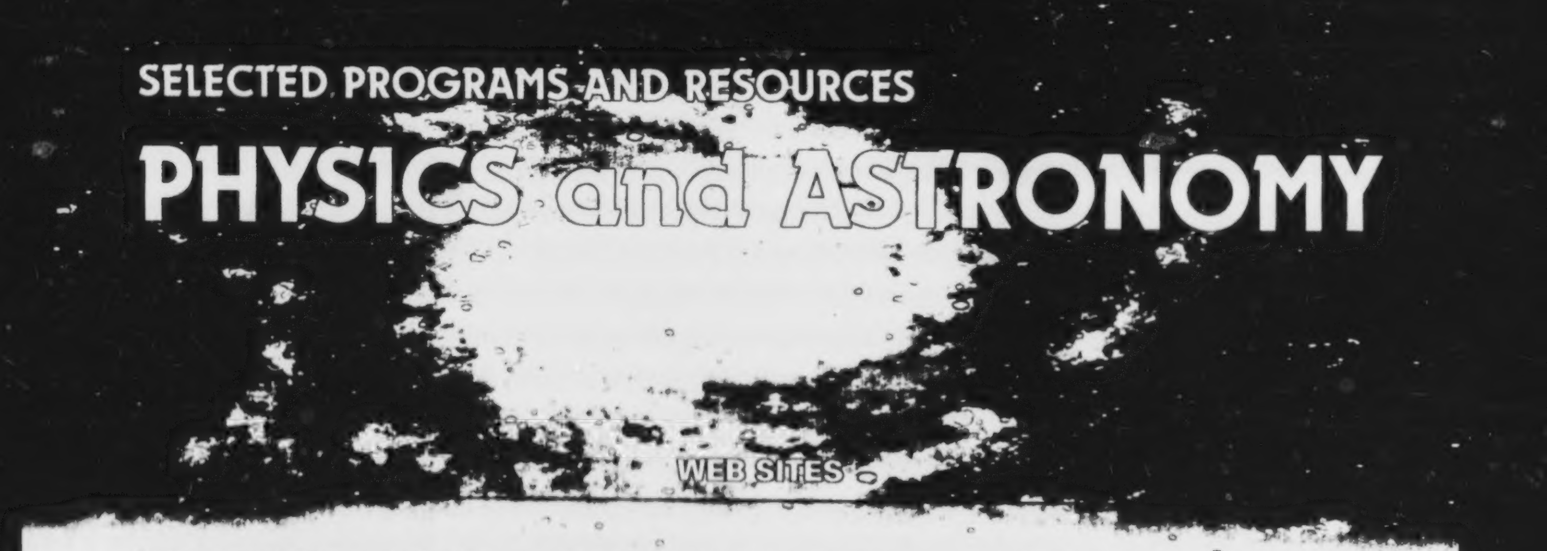
The Physics Classroom: Sound Waves and Music. Clear, extensive, well-organized site with many helpful animations. One of a suite of tutorials designed by a high school physics teacher. www.physicsclassroom.com/Class/sound/soundtoc.html

Fourier Synthesis. Make your own waves! See for yourself how complex waves can be created from simple sine waves, and hear the resulting tones. www.phy.ntnu.edu.tw/java/sound/sound.html

Books

Music, the Brain, and Ecstacy: How Music Captures Our Imagination by Richard Jourdain (William Morrow & Co., 1997).

The Science of Sound, 2nd edition by Thomas D. Rossing (Addison-Wesley, 1990).



SELECTED PROGRAMS AND RESOURCES

PHYSICS and ASTRONOMY

WEB SITES

Astronomy Picture of the Day
http://antwrp.gsfc.nasa.gov/apod/astropix.html
Each day a different image or photograph of our universe is featured, along with a brief explanation written by a professional astronomer.

AstroWeb's Educational Resources in Astronomy
http://webhead.com/wwwvl/astronomy/astroweb/yp_education.html
Twenty-two printed pages of astronomy links.

Eric Weisstein's Treasure Troves of Science
www.treasure-troves.com/physics AND www.treasure-troves.com/astro
The Treasure Troves site is an extensive online encyclopedia of math and science. Both Physics and Astronomy have a large index of definitions, as well as links to thousands of files.

Genesis Mission
http://genesismission.jpl.nasa.gov
Learn more about NASA's Genesis mission, which launched its spacecraft to collect pieces of the sun, called solar wind, on August 8, 2001.

Multimedia Physics Studios
www.glenbrook.k12.il.us/gbssci/phys/mmedia/
A collection of GIF animations and accompanying explanations of major physics concepts that are typically covered in a first-year high school physics course.

Neat Sites in Astronomy
http://lab2.cc.wmich.edu/korista/astro-etc.html
This site is a comprehensive list of astronomy links, including astro history, the Sun, solar system explanation, women in science, cosmic literature, tips for astronomers, buying stars, astronomical pictures, tutorials, and much, much more.

Physics Central
www.physicscentral.com
Find out how physics is part of your world. This site tells you how things work and gives you up-to-date physics information. Also contains a list of physics links.

Physics Classroom
www.physicsclassroom.com
An online physics tutorial written for high school physics students. Learn basic physics concepts and quiz yourself at the end of each lesson.

Physics Demonstrations
http://ldaps.ivv.nasa.gov/Physics/
Links to experiments on force, torque, energy, pressure, velocity, Bernoulli's equation, and lift and drag—all provided by NASA.

Physics Internet Resources
www.het.brown.edu/physics
A comprehensive list of academic Internet resources. Be sure to keep up with the latest news in physics by clicking on Physics News.

Slinky Home Page
www.messiah.edu/hpages/facstaff/barrett/slinky/home.html
Learn about compression waves, centripetal force, and other physics concepts through these experiments using a Slinky.

SpaceDaily
www.spacedaily.com
A vast collection of news articles about space.

Stephen Hawking's Universe
www.pbs.org/wnet/hawking/html
Read about Stephen Hawking's discoveries, past and present, that have revolutionized the way we think. From the Big Bang to black holes, from dark matter to a possible Big Crunch, hear what this theoretical physicist has to say.

Today@NASA.gov
http://www.nasa.gov/today/
This online newsletter, updated daily, contains the latest news about NASA science and technology.

Your Sky
www.fourmilab.ch/yoursky
This site is an interactive planetarium on the Web. You can produce maps for any time and date, viewpoint, and observing location.

For these and additional links, see the Imagine Links page for this issue: www.jhu.edu/gifted/imagine/links_92.htm

BOOKS

PHYSICS

The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory by Brian Greene (Vintage Books, 2000).

The Hole in the Universe: How Scientists Peered over the Edge of Emptiness and Found Everything by K. C. Cole (Harcourt Brace, 2001).

The Non-Local Universe: The New Physics and Matters of the Mind by Robert Nadeau and Menas Kafatos (Oxford University Press, 2001).

Q Is for Quantum: An Encyclopedia of Particle Physics by John and Mary Gribbin (Touchstone Books, 2000).

Three Roads to Quantum Gravity by Lee Smolin (Basic Books, 2001).

ASTRONOMY

Deep-Sky Companions: The Messier Objects by Stephen James O'Meara and David H. Levy (Cambridge University Press, 2000).

Parallax: The Race to Measure the Cosmos by Alan W. Hirshfeld (W. H. Freeman and Co., 2001).

Skywatching by David H. Levy (Time Life, 2000).

Stars and Planets by Ian Ridpath (Princeton University Press, 2001).

Turn Left at Orion: A Hundred Night Sky Objects to See in a Small Telescope—and How to Find Them by Guy Consolmagno and Dan M. Davis (Cambridge University Press, 2000).

PROFESSIONAL ORGANIZATIONS

The Web sites of the following organizations include valuable information about education and careers, as well as useful links.

Acoustical Society of America
http://asa.aip.org

American Association of Physicists in Medicine
www.aapm.org

American Astronomical Society
www.aas.org

American Institute of Physics
www.aip.org

American Physical Society
www.aps.org

The Astronomical League
www.astroleague.org

The Astronomical Society of the Pacific
www.astrosociety.org

Name That Physicist!

Match the names of the famous physicists to their contributions in science.

1. James Chadwick
2. Michael Faraday
3. Albert Einstein
4. Niels Bohr
5. Max Planck
6. Marie Curie
7. Isaac Newton
8. Ernest Rutherford
9. Werner Karl Heisenberg
10. James Clerk Maxwell

A. Provided the first explanation of radioactivity and discovered the nuclear structure of the atom.
B. Proposed the quantum theory and explained wavelength distribution of blackbody radiation.
C. Explained the laws of motion and universal gravitation and invented differential calculus.
D. Formulated the kinetic theory of gases and the theory of electromagnetism.
E. Contributed to the creation of quantum mechanics and introduced the uncertainty principle.
F. Discovered electromagnetic induction and devised the first electrical transformer.
G. Explained Brownian motion and photoelectric effect and formulated the theory of relativity.
H. Discovered radioactivity of thorium and co-discovered radium and polonium.
I. Founded the modern quantum theory of matter and the theory of nuclear reactions and nuclear fission.
J. Proved the existence of neutrons.

Answers: 1. J, 2. F, 3. G, 4. I, 5. B, 6. H, 7. C, 8. A, 9. E, 10. D

My Life

by Susanna Ferguson

As the bold tones of the last note faded into the auditorium, I took my bow off the string with a flourish and a smile creased my face. Who cared if I was only one of 30 musicians who had performed relatively simple music for an audience of parents and friends? Who cared if I hadn't even gotten to play one of the two cello solos? I felt like a star, and I knew that I had helped to create something beautiful.

I started playing the cello in fifth grade. There was a meeting at my school for all the students and parents who were interested in the music program, where each instrument was played and its pros and cons were briefly discussed. I had already decided that I wanted to play a stringed instrument, but I had to pick which one. I had four to choose from: violin, viola, cello, and bass. Everybody plays the violin—far and away the most popular instrument—and there are always huge classes. The viola has the opposite problem: nobody plays the viola. Plus, I didn't think violists had any interesting music to play. The bass was immediately ruled out because not only does it weigh a ton, but bassists hardly ever get to play the melody. So that left the cello. I began to play, and I loved it immediately.

Practicing the cello has never been a chore for me. But when friends complain about having to practice their instruments, I can relate. The year before I started playing cello, when I was nine, my parents wanted me to learn the piano. I don't know what was wrong, but the piano and I never clicked. Even after nine months of practice, I had yet to master the concept of playing different things with each hand. During that time, I remember putting off practicing until the last possible moment, and then spending 20 minutes resentfully and half-heartedly trying to make music. One thing I have since learned about music is that it cannot be done half-heartedly.

Playing an instrument is like having a difficult friend. As with any relationship, it's always give-and-take. I fight with my cello. I sit there for hours cursing it, wishing it were dead. But there are also amazing moments, when I figure out how to put my heart and soul into the music and I make something beautiful. And I realize how incredible it is to be able to do that, even if it is just for one note. For me, that is the only thing that matters.

The first time I had one of these magical moments with the cello was about three months after I had started playing. I had mastered the basic basics; I could play fairly well in tune and I was beginning to play simple music. My orchestra conductor handed out a piece for our next concert called *Theme From Ice Castles: Through the Eyes of Love*. She played it on the piano for us, and I was mesmerized. It was like love at first sight (or hearing, I guess). I was determined to play it.

It was a little beyond my reach as a musician, but I had made up my mind. That night, I went home and practiced for four hours, playing that one gorgeous melody over and over. By the end of the night, my fingers were throbbing and I was convinced my arm was going to fall off, but it still wasn't perfect. Finally, I took time to really listen to the sounds I was making. And they were beautiful. I couldn't believe I was responsible for the heartbreakingly lovely sounds that filled the room. I promised myself that I would find all the music that gave me that power, and I would play it. Play it beautifully. I relive that moment of revelation every time I play a Bach suite, a Fauré romance, Saint-Saens's *The Swan*. The list is growing.

But playing the cello isn't always pure joy. I still have my frustrations, my bad days, my fears. For me, fear is a big part of being a cellist, especially when I perform. Recitals in particular are terrifying. It is as if I am on cruise control because I can't feel my fingers. I just have to

as a Cellist

hope that I practiced enough and that my fingers will hit the right places. The sounds that I make, all alone out there on the stage, are the sole focus of the audience's attention. Playing solo music is just that: solo. Alone.

Performing itself is scary enough, but when you add judges, as in a master class, audition, or competition, the fear factor goes up exponentially. Not only are you exposing a product of your heart and soul to the judges, but you are pitting it against the products of others. You are afraid of everything: humiliation, pity, mocking laughter. You are afraid that after you play, other musicians will cackle to themselves, "I knew I was better than she was!" And you fear that they might be right! In order to perform, I have to bite down those fears, grit my teeth, and physically force myself to stop trembling.

While all these thoughts whirl around in my head, while the terror is striking chills in my heart, while my mind is foggy with fear, I still have to create beauty. I have to remember the feeling I had when I heard myself play for the first time and how gorgeous those sounds were. Then I get past my fear, and the music takes over. ■

Susanna Ferguson is a ninth grader at Holmes Junior High School in Davis, CA. She enjoys playing the cello, writing, reading novels, playing field hockey and soccer, horseback riding, and spending time with her friends.

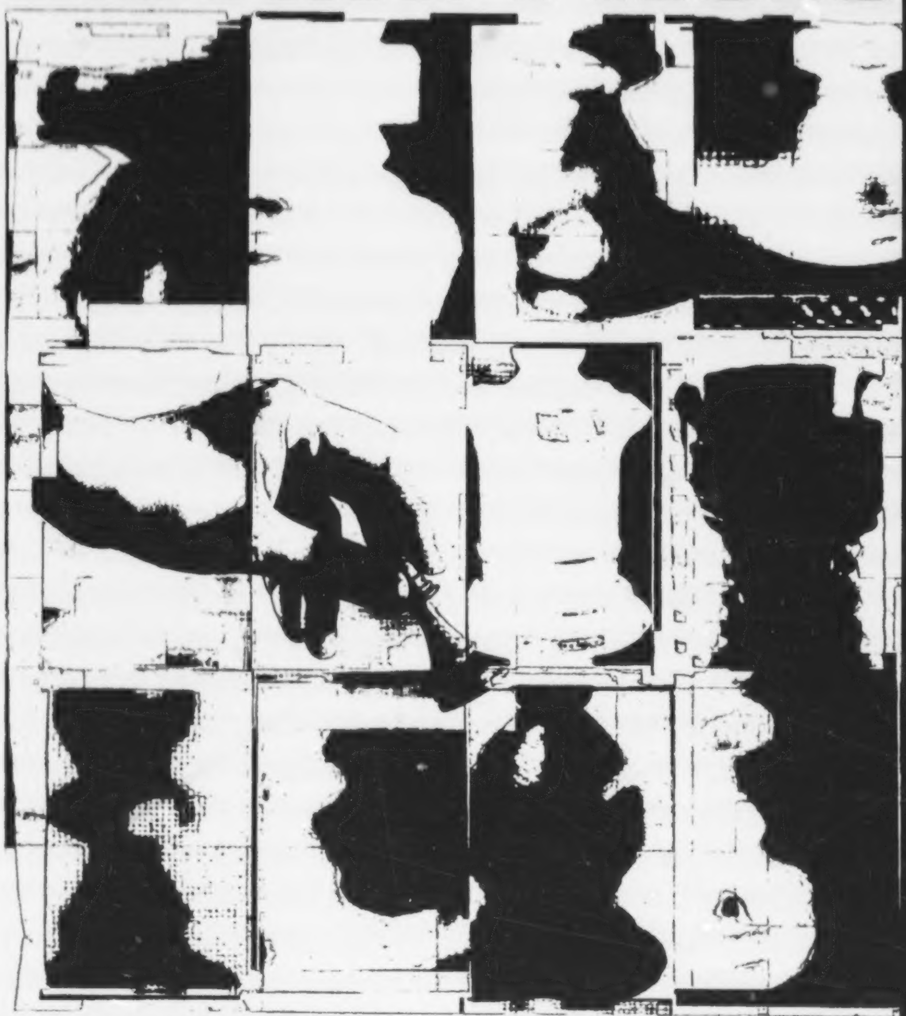
"Not all artists may be chess players,

MOVING PIECES

by Patrick Mihelich

I was playing on the second board at the Supernationals chess tournament. The stakes were high: the winner would play for the title of K-9th grade national champion. On my left, rows of spectators watched the top games being played. To my right, the demonstration board duplicated the moves of my game for the benefit of the "fans in the stands," and beyond that stood the rows and rows of shiny red trophies that would be awarded to the top finishers. At the time, however, my full attention was focused on the board in front of me. I had no time for distractions.

That feeling of focus has always attracted me to chess tournaments. I played in my first chess tournament in fourth grade at the suggestion of the coach of the school chess club, and I was instantly hooked. The thrill of competition, the often intense pressure to win, and the quiet of the tournament hall combine to raise my concentration to a level I seldom experience elsewhere. For a time, I am completely immersed in the position at the board; the rest of the world is replaced by the subtle interplay of pieces and pawns. Sometimes other players will crowd around my board to watch the finish to my game, but I hardly notice.



Skill, Strategy, and Art in Chess

A Test of Endurance

Success in chess depends in part on developing the discipline to maintain this alertness throughout an entire game. On this level, chess games sometimes become tests of endurance. I recently won a game at the World Open in Philadelphia after six hours of play lasting until midnight. Objectively the game should have been a draw, but my opponent was tired from the long game and missed a couple of tricks, while I nearly threw away the win by missing a simple move.

Despite doing nothing more strenuous than moving the pieces, I am often completely exhausted at the end of a long day of competition, which typically involves multiple games. I find it no great surprise, therefore, that the International Olympic Committee is now considering chess as a possible Olympic sport.

This psychological element of chess is also present in many other disciplines, often seemingly unrelated. In July 1998, after I had been playing competitively for two years, I contacted a local chess master, seeking a mentor to help me improve my skills. When he replied, he recommended a few books, and I was surprised to find that none of them was about chess! Instead of manuals of opening moves or collections of tactical exercises or books on the endgame, he suggested several books on golf and tennis—specifically, the psychological aspects of those games.

but all chess players are artists" —Marcel Duchamp

Finding a Chess Community

A short while later, I began attending a small chess club that my mentor hosts at his house every Thursday night. The atmosphere I found there was quite different from the one I was used to at chess tournaments. We start each night by eating together, talking and relaxing. Then we play chess.

At tournaments, the entire focus is on winning. There is no reward for playing a good game; a loss is a loss. Losing by exceeding the time limit just a second before checkmating your opponent counts the same as losing by being blown away by a devastating attack. At the chess club, however, the goal is to become a better player; winning is only the icing on the cake. Despite being the only non-adult in the club, I have always felt very welcome there. I've made many friends at tournaments, but it wasn't until I came to my mentor's house that I felt a true sense of chess community.

While this environment doesn't have quite the thrill of a large tournament, it is immensely enjoyable to play in because of the greater freedom it offers. During competitive play, it is nerve-racking to take risks, such as trying a sequence of unfamiliar opening moves or sacrificing pieces and pawns for a speculative attack. In the more relaxed setting of the club, however, I am free to experiment and take risks. I also don't have to worry about running out of time. We use chess clocks, but only to give us some perspective on how long we are taking to move. While a tournament leaves me feeling drained, Thursday nights only make me eager for more.

In addition to being fun, the chess club has dramatically improved my playing ability, in part because it gives me a place where I can play each week and keep my skills sharp. More important, though, is the cooperation among the players. After each game, my opponent and I discuss where we went wrong and what we could have done better. Analyzing your own games is a great way to improve, but seeing your opponent's perspective is even more beneficial. We also frequently work together on difficult problems and complicated positions, talking them through until we find solutions.

The most exciting part, then, is applying what I've learned at the club to tournament situations. Moves, ideas, and strategies from one game can often be transplanted to another very effectively. For example, one night at the club my opponent tried playing a slow, solid opening against me, and I was able to gain a positional advantage and squeeze his position to death. This experience came in handy at the recent Indiana State Chess Championship. My opponent, an expert, was substantially higher-rated than I, but I soon became confident when he entered the exact same opening. Our first 15 or so moves were identical to those in that game at the club. I improved on my own play and again won, this time with a swift attack.

The Value of Chess

Chess has taught me skills that will serve me well throughout life. Because it is so important to see ahead several moves and think the position through logically, chess has helped me become better at analyzing difficult problems in real life. Chess has also taught me patience. It is always tempting to get an immediate advantage, but often it is better to simply continue strengthening your threats, without actually carrying them out, until your opponent's position cracks. In chess, you cannot hurry; you must take things one step at a time.

Finally, chess has taught me to accept defeat and move on. I narrowly lost that game on the second board at the Supernationals; I was simply outlasted by my opponent. But I recovered in the next game, my last in the tournament, by picking a strategy early on and following it methodically to the end. I ended up seventh in the nation, went home with a trophy, and started looking ahead to the next tournament. ■

Patrick with his 6th-place trophy from the 1999 National Scholastic K-12 Championships.

Patrick Mihelich **is a sophomore at Park Tudor School in Indianapolis, where he plays soccer and is a member of the tech theater crew. Patrick also plays clarinet in the high school band and in the Indianapolis Wind Ensemble. This past summer he was a junior counselor at the Ross Young Scholars Program. In December, he will play in the U.S. Chess Federation's National Scholastic Championships in Dallas.**

SELECTED CHESS RESOURCES

Bobby Fisher Teaches Chess by Bobby Fisher (Bantam Books, 1992).

The Complete Idiot's Guide to Chess by Patrick Wolff (Alpha Books, 2001).

Logical Chess: Move by Move by Irving Chernev (Brasseys, Inc., 1995).

U.S. Chess Federation www.uschess.org Includes links to tournaments, clubs, and camps, as well as opportunities for correspondence chess. Parents, coaches, and players of all abilities will find resources here.

Off The Shelf

"The Overcoat"

A short story by Nikolai Gogol

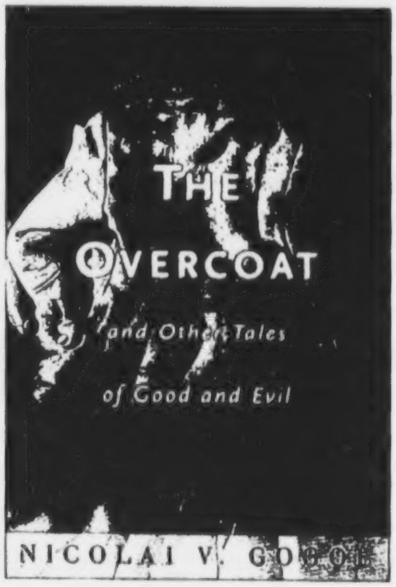
Review by Ilja Ryzhov

Nikolai Vasilyevich Gogol is acknowledged as one of the greatest Russian writers. Though perhaps best known for his unfinished novel *Dead Souls*, Gogol also wrote numerous short stories, including "The Overcoat," published in 1835. Later, Fyodor Dostoyevsky said of himself and other realist writers, "We all came out of Gogol's 'Overcoat.'" Indeed, "The Overcoat" is one of the most famous landmarks of Russian literature, a powerful social statement as well as a tragic and poignant story.

The protagonist is Akaky Akakievich, a man who works in a government office as a clerk, copying papers day and night. He talks to no one, and his co-workers make fun of him for having a dirty overcoat.

One day, Akaky Akakievich realizes that his coat has become so tattered and worn that it is useless. When he takes it to the tailor to have it mended, he learns that it can't be repaired. He needs a new one, which will cost one-fifth of his yearly salary. And so he endures poverty for months, forgoing tea, candlelight, and necessities to save money for the new overcoat. When it is finally made, Akaky Akakievich becomes a new man overnight. His co-workers barely recognize him and are so amazed by his wonderful coat that they invite him to a party that evening. On his way home from that party, he is attacked and his coat is stolen.

For a while he tries to do something about it. He even dares to bother a superior—an "important personage"—to ask if maybe, possibly, he could speak to the Superintendent of Police or someone else about his overcoat. Akaky is sharply rebuffed, and, with no hope of getting the overcoat back, he lies in bed for a week with fever and dies. No one comes to his funeral or even notices that he is gone.



But that's not the end of the story: In the form of a ghost, Akaky Akakievich wanders the streets at night, stealing the overcoats of well-to-do people. The final overcoat he takes is that of the "important personage" who yelled at him earlier.

Despite the grimness of the story and the futility of Akaky Akakievich's situation, one can see humor—a very sarcastic and bitter sort of humor—in the writing. Gogol delights in mocking every government official and authority figure in the story. When Akaky's ghost begins stealing overcoats, the watchmen are directed by their superiors to "catch the ghost at any cost, dead or alive, and to punish him with due severity as a warning to others." When they fail, they become "so afraid of the ghost that they [feel] reluctant to interfere with live robbers and [content] themselves with shouting at them from a distance."

Gogol's loathing for rigid Russian bureaucracy is evident throughout this story, but he also notes that its negative qualities do not necessarily extend to the individual people who make up the bureaucracy. The "important personage" whom Akaky Akakievich comes to with a plea for help, for example, is described as "a good and obliging friend." However, his good qualities evaporate whenever he is in his role of superior.

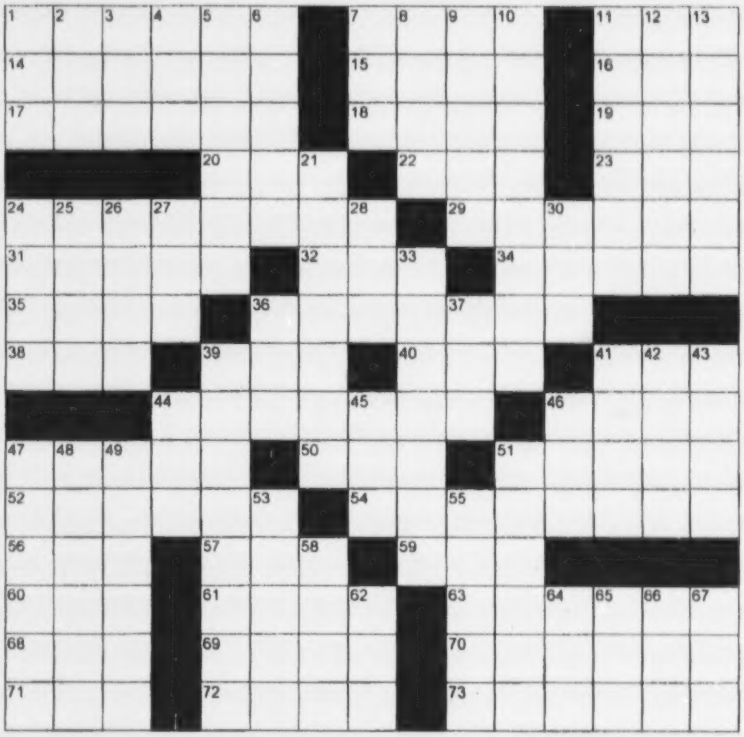
Although Akaky Akakievich is crushed by the system and ultimately dies, he still has his moment. When the "important personage" loses his overcoat, there's a sense that the little clerk has won and that the guilty have been punished. The ending at first alleviates the feeling of hopelessness that the rest of the story evokes. But in reality, it is even more hopeless: If the only way to win is after you're dead, in a whimsical fairytale resolution, then there really is no way to win at all.

Nineteenth-century literature reflected a growing awareness of social injustice. In the west, such authors as Victor Hugo and Charles Dickens became famous for their understanding of the plight of the "wretched poor" and are labeled "champions of the downtrodden" by critics. In Russia, authors like Dostoyevsky achieved similar acclaim, all admitting to having been influenced by Gogol—and "The Overcoat" in particular. To this day, "The Overcoat" remains widely read in Russia, its characters recognized, its message alive, and its bitter, witty social commentary influencing another generation of writers. ■

Ilja Ryzhov won a Silver award in the Scholastic Art and Writing Awards for his writing portfolio that contained, among other writings, a longer version of this book review. Ilja is now in his first year at Cornell University, where he plans to major in computer science.

Word Wise: Starry, Starry Night

by Carol Blackburn



ACROSS

1 Quasi-stellar radio wave emitter
7 Wooden shoe
11 Queue
14 Spain
15 Space organization
16 Pertaining to the environment (prefix)
17 Shoot! (2 wds.)
18 Constellation Cygnus
19 Under (prefix)
20 Club __
22 Heavens
23 Online broker (abbr.)
24 Celestial seven sisters
29 Neither moral nor immoral
31 Orion's knee
32 Delay
34 Between (Fr.)
35 Above
36 Uranian moon
38 My (Fr.)
39 Pester
40 Co-recipient of 1996 Nobel Prize in physics for the discovery of superfluidity in helium-3
41 Drain
44 Pulsating star that varies regularly in brightness
46 Distant (Gk.)
47 Mistake
50 __ Shi'ar, the Romulan intelligence service
51 Bustling
52 Aviators
54 Phenomenon that enabled Hubble to deduce that the universe is expanding
56 Icon (file name extension)
57 Unprocessed
59 Office of Emergency Planning (abbr.)
60 Mr. Howard
61 Terrible tzar
63 Image-forming element in some telescopes
68 Lou Gehrig's disease (abbr.)
69 Exploding star
70 Source
71 Feline constellation
72 Mined metals
73 Latin for "mist" or "dust"

DOWN

1 Quantum electrodynamics (abbr.)
2 Second country to put a man in space
3 Spring month (abbr.)
4 Saint (Sp.)
5 Creature
6 Ranked
7 Central nervous system
8 Newton's ___
9 Japanese city
10 Largest Jovian moon
11 Spa
12 Eyepiece
13 How astronomers detect extrasolar planets
21 Please
24 British baby carriage
25 Low-cal
26 Ids' counterparts
27 Individual education program (abbr.)
28 Synthetic aperture radar (abbr.)
30 Bird __ wire (2 wds.)
33 Italian astronomer
36 Chart
37 Edward, to his friends
39 Dark matter constituent
41 Extraterrestrial life seeker (abbr.)
42 First letter in Arabic alphabet
43 Saucy
44 Chief financial officer (abbr.)
45 Organ of audition
46 Thyroid stimulating hormone (abbr.)
47 Shape of the Milky Way galaxy
48 Fiery star
49 *The Tempest*'s King
51 Strive for
53 Appreciate
55 Maxwell's ___
58 ___-particle duality
62 National Academy of Science (abbr.)
64 Tease
65 Revenue-generating unit (abbr.)
66 Lubricate
67 Transfer or messenger

Solution on page 34

Planning Ahead for College

College Planning Schedule: Grades 10, 11, 12

by Linda E. Brody, Ed.D.

Part I, for grades 7-9, appeared in the last issue of Imagine.

To be fully prepared for college, you must begin planning early: take challenging courses, gain academic skills, participate in activities, and garner the credentials that will appeal to the college of your choice. We offer this planning schedule to help you manage the process.

Grade 10

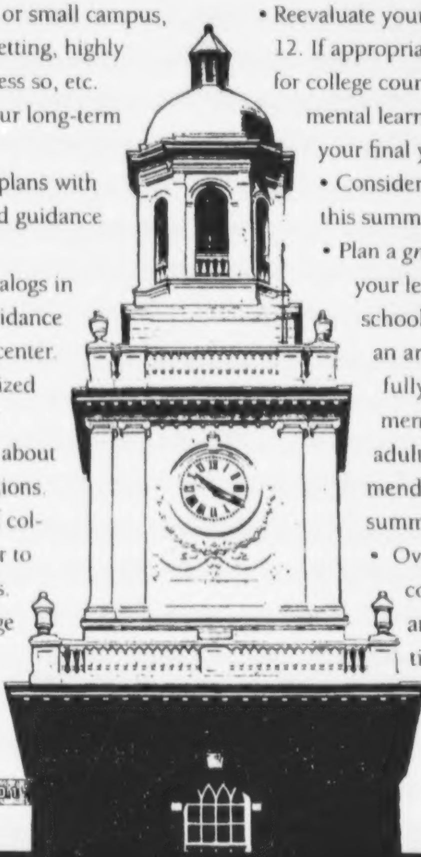
You have the luxury this year of exploring colleges without pressure. Take advantage of it.

- Take the PSAT in the fall for practice.
- Get more involved in extracurricular activities that you enjoy.
- Read college catalogs and investigate other resources in the guidance office and on the Internet.
- Attend a college fair.
- Visit college campuses, keeping notes on positive and negative attributes.
- Explore careers through part-time jobs, volunteer activities, internships, and mentorships.
- Take SAT II Achievement tests and AP exams relevant to your courses.
- Reevaluate your high school program with a guidance counselor. If you are running out of challenging courses, consider part-time college courses. If you plan to graduate early, plan to take the most advanced courses possible during your final year of high school.
- Read books, magazines, and newspapers in your free time.
- Use your summer to expand your learning: take a course, travel, and/or pursue volunteer work in an area of interest.

Grade 11

This is probably your most important year for establishing a strong academic record and proving your commitment to extracurricular efforts.

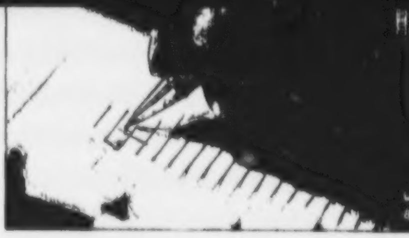
- Evaluate your courses, study habits, and extracurricular activities to maximize your performance in all areas.
- Take the PSAT in the fall; scores will be used for the National Merit Scholarship Qualifying Test.
- Think seriously about what you want in a college: big or small campus, urban or rural setting, highly competitive or less so, etc. Contemplate your long-term goals.
- Discuss college plans with your parents and guidance counselor.
- Read college catalogs in your school's guidance office or career center. Use a computerized college search if available. Learn about financial aid options. Develop a list of colleges that appear to meet your needs.
- Meet with college admissions representatives who visit your school; attend a college fair.
- Talk with graduates of your high school about their college experiences.
- Visit as many colleges on your list as possible, preferably during the school year. Call ahead to arrange an admissions interview, tour, and overnight dorm stay.
- Focus on the extracurricular activities you enjoy most. Work to assume a leadership role in one or two activities.
- Practice for the SATs with old tests.
- Take the SAT I—and the ACT, if it's required by any colleges on your list.
- Take SAT II exams in courses that you complete this year, as well as those required by colleges you are considering for Early Decision. Regular admission candidates can take some exams senior year.
- Take AP exams for any AP courses you took this year.
- Continue to read books, magazines, and newspapers in your free time.
- Reevaluate your program for grade 12. If appropriate, make arrangements for college courses or other supplemental learning opportunities for your final year of high school.
- Consider working with a mentor this summer or next year.
- Plan a *great* summer. Increase your learning beyond high school offerings or develop an area of interest more fully. If appropriate, ask a mentor, teacher, or other adult for a college recommendation based on your summer experiences.
- Over the summer, write to colleges for admissions and financial aid applications.



Grade 12

This is your final year for decision-making.

- Continue to work hard to excel in school. Don't succumb to senior slump; colleges may rescind an offer of admission if your grades drop dramatically.
- Show commitment to extracurricular interests through leadership and/or high achievement.
- Retake the SAT I if you believe your score will improve. Take remaining SAT II tests.
- Meet with college admissions representatives who visit your school.
- Discuss your college preferences with your counselor. Be sure your final list includes at least one college where you are sure to be accepted *and* where you will be happy.
- Visit additional colleges, if necessary.
- Sign up for college interviews. Send thank-you notes afterwards.
- Ask for letters of recommendation from your teachers and guidance counselor.
- Mark your calendar with admission deadlines. Prepare all application materials carefully. File your application and all supplementary materials—recommendations, transcripts, standardized test scores, financial aid information—on time.
- Check with college admissions offices to verify that they have received all your application materials.
- Take AP exams for this year's AP courses.
- If you're still undecided about which college to choose when acceptances arrive, plan a visit and stay in a dorm.
- Send thank-you notes to your guidance counselor, teachers, and anyone else who helped you in the admissions process.
- Continue to read books, magazines, and newspapers in your free time. This knowledge base will help you in college.
- If you weren't accepted to your first choice school, put that behind you. A positive attitude and the determination to get the most out of college will help make it all you want it to be. ■



Mark your calendar...

with these November–January registration deadlines for selected academic competitions. Inquire about competition format, dates, and fee

NOVEMBER 1/DECEMBER 14
MATHCOUNTS—Schools register 7th and 8th graders; participants compete in chapter meets; state contests in March. MATHCOUNTS Foundation, 1420 King Street, Alexandria, VA 22314; (703) 684-2828; mathcounts@nspe.org; www.mathcounts.org

DECEMBER
JETS-TEAMS Competition—Schools register teams, grades 9-12; call for exact state deadlines. Junior Engineering Technical Society, 1420 King Street, Suite 405, Alexandria, VA 22314-2794; (703) 548-5387; jets@nae.edu; www.jets.org

DECEMBER 20/JANUARY 20
American Mathematics Competitions (AMC->10 & AMC->12)—First qualifying round for the USA Mathematical Olympiad; schools register, grades 9-12; lower fee for earlier date; exam date is February 12, 2002. Titu Andreescu, Director, American Mathematics Competitions, University of Nebraska-Lincoln, Lincoln, NE 68588-0658; (402) 472-6566; amcinfo@unl.edu; www.unl.edu/amc/

JANUARY 10
National Latin Exam—Latin teachers register students in Intro Latin–Latin 5; Exam given in March. ACL/NCJL, National Latin Exam, P.O. Box 95, Mount Vernon, VA 22121; (888) 378-7721; www.vroma.org/~nle/

JANUARY 12
Profile in Courage Essay Contest—Students in grades 9–12 write a 1,000-word essay about an elected official who has acted courageously to address a political issue. John F. Kennedy Library, Profile in Courage Essay Contest, Columbia Point, Boston, MA 02125; (617) 929-1204; profiles@kennedy.nara.gov; www.cs.umb.edu/jfklibrary/

JANUARY 15
Ernest Hemingway Writing Awards—High schools enter two students in each of the following categories: feature writing, news writing, sports writing, and commentary. Hemingway Awards, The Kansas City Star, 1729 Grand Blvd., Kansas City, MO 64108; (816) 234-4907; www.kcstar.com/aboutstar/hemingway/hem2.htm

JANUARY 15
National Mythology Exam—Schools register students in grades 3-9. American Classical League, Miami University, Oxford, OH 45056; (513) 529-7741; www.mythologyexam.org/

JANUARY 22
National Physics Olympiad—Students submit application to high school physics teacher or counselor to be nominated to take qualifying exam. AAPT, One Physics Ellipse, College Park, MD 20740-3845; (301) 209-3344; aapt-prog@aapt.org; www.aapt.org/olympiad/ *(See page 10 for an article about this competition.)*

JANUARY 23
National Peace Essay Contest—Students in grades 9–12 submit 1,500-word essay on yearly topic (2002 topic: Debating the U.S. Military's Role in International Peacekeeping). Students need sponsorship to enter; see Web site for details. U.S. Institute of Peace, Peace Essay Contest, 1200 17th Street NW, Washington, DC 20036; (202) 429-3854; www.usip.org/ed/Programs/NPEC/npec.html

BOWDOIN COLLEGE

The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 25 students, who major(ed) in anthropology (2), art history (1), biochemistry (1), biology (5), chemistry (2), economics (2), English (3), environmental studies (2), French (1), history (2), government (3), philosophy (1), physics (1),psychology (3), Russian (1), sociology (2), and studio art (1). (The number of majors exceeds 25 because several students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Founded in 1794, Bowdoin College is currently ranked number 5 in U.S. News & World Report's ***annual rating of the nation's liberal arts colleges. Reviewers praised the quality of education at Bowdoin, especially the dedication of the faculty to undergraduate education.***

➤ "*U.S. News & World Report* provides statistics on student-to-faculty ratio, but it cannot measure the *quality* of those relationships, and that was what made my Bowdoin experience truly rewarding. Professors know students individually and genuinely care about their academic and personal pursuits. They are friendly, encouraging, inspiring, enthusiastic, and of course, extremely knowledgeable. With all my professors, I felt comfortable stopping by any time. I cannot say enough positive things about the professors I got to know over the years, and who continue to inspire me to this day."

➤ "Nearly every one of my classes at Bowdoin had the promise of being an astoundingly enriching experience, and it was up to me to rise to that opportunity. Students are encouraged and even required to make meaningful contributions to class dialogues.

➤ "The professors at Bowdoin are brilliant, approachable, and committed to inspiring Bowdoin students. I now attend graduate school at an Ivy League school and have been disappointed not to find the same high quality of instruction or level of academic challenge that I experienced at Bowdoin. The economics, government, biology, and chemistry departments are particularly strong."

➤ "There is an amazing range of classes for such a cozy school. Even as a French major with an economics minor, I had time to take fabulous classes in religion, chemistry, marine biology, philosophy, acting, and art history. The largest classes I took (75-100 students) were the intro-level science courses. In my major, the largest class I ever took had 20 people."

➤ "The flexible core curriculum is a good starting point for a liberal arts education. Students must take two classes in each of four areas: natural sciences and mathematics; behavioral sciences; humanities and fine arts; and non-Eurocentric studies. It is pretty easy to satisfy the requirements while taking classes that you are truly interested in. (Some might even say the core is *too* flexible, as it allowed me to avoid taking courses I thought I would struggle with.) With the small classes, opportunities for independent study, and liberal policy concerning self-designed majors, students are very able to shape their own college experiences."

➤ "Bowdoin's location so near the coast and the college's 118-acre Coastal Studies Center make Bowdoin a wonderful place for students interested in coastal and environmental studies. And the state is fascinating geologically—great for field trips. The interdisciplinary Environmental Studies major gives students an opportunity to see how the environment relates to a wide range of disciplines."

Social Life

Social life centers on campus activities, friendships, and enjoying Maine.

➤ "As at most small colleges, social life is campus-based. Most students live on or near campus, making it easy to see friends and feel a strong sense of community. The campus is lovely, with an attractive mix of architectural styles and magnificent trees that turn glorious colors in the fall. There are lots of activities and clubs. The most popular is the Outing Club, which leads 4 or 5 different activities every weekend, from kayaking to rock climbing to skiing to spending nights in a cabin the college owns."

➤ "Special interest clubs range from art and theater to horseback riding to international affairs. At Bowdoin, you can be an active member from the start—I became a club president as a freshman. Bowdoin not only taught me in the classroom; it also helped me obtain wonderful skills in management and human relations."

➤ "Bowdoin attracts a very high caliber of people, and students make lifelong friends there. It's small enough that you get to know everyone, if only by sight. I loved walking around campus and feeling at home. I never felt limited because there were still so many students I wish I had gotten to know better. The student body is quite diverse in their interests, if not in their cultural backgrounds. Despite the lack of cultural diversity, most students are eager to explore other cultures and experiences."

➤ "Much of the social life is organized by the 'college houses,' which replaced the fraternity system. Each first-year dorm is associated with a house, which plans activities for their affiliates and for the entire student body. There is one chemical-free house and associated dorm. My college house was integral to my social life. We hosted informative forums, facilitated community service projects, and (most importantly) threw great parties. Some students complain that Bowdoin's homogenous student body generates a bland and repetitive social life, but I found plenty to hold my interest there."

➤ "Brunswick is a small, welcoming town that gives students access to the things they need but is not a distraction. Freeport, a shopping mecca, is 15 minutes away. Portland, the largest city in Maine, is 40 minutes away. Its renovated waterfront has great restaurants, a vibrant arts community, and some fun clubs. Boston is about 3 hours away."

➤ "The location is exceptional. The coast is 10-15 minutes away by car, and some students live in houses right on the water. The coastline near Bowdoin is very irregular, with long fingers of land reaching out into a bay dotted with tiny islands. It's great for sailing and for long bike rides along the shore. The Maine coast is beautiful in all seasons and it's a privilege to be able to go there whenever you want to, or when you need to put things in perspective."

What Do You Like Best about Bowdoin?

➤ "The atmosphere at Bowdoin is warm, friendly, noncompetitive, unpretentious, laid-back, and comfortable. I felt welcome from the moment I stepped on campus and continue to be overwhelmed by that feeling every time I return. As trite as it may sound, the Bowdoin community honestly feels like a family, and people truly care about each other."

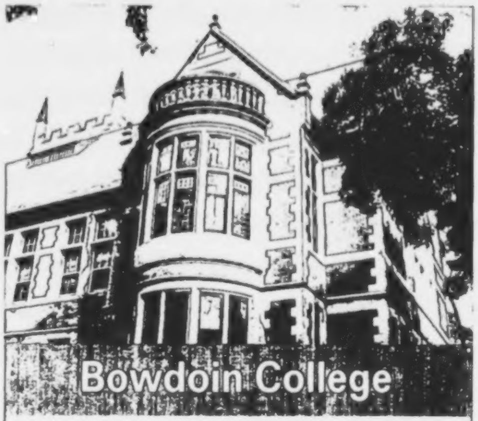
➤ "There was so much to love. I loved the closeness of my relationships with my professors. I loved being around people who were really interested and cared so much about learning. Students are there for the college and to experience Maine, not because of a flourishing bar scene or great internship opportunities. And I loved Maine. It's a great state to live in, even if only for a short while."

What Do You Like Least about Bowdoin?

➤ "Winters are cold and long! It's really important to stay active or you can end up hibernating and feeling rather blue. Also, if you don't study abroad (which 50-70 percent of juniors do), Bowdoin can feel really small by senior year."

➤ "Because classes are so small and participation is strongly encouraged, one annoying person can have a noticeable impact on a class."

➤ "A small college cannot offer the range of upper-level courses a university can. When I began graduate school, I felt a little lost because some of my fellow grad students knew more than I did. I caught up quickly because I had learned how to figure things out for myself at Bowdoin, but the transition was not an easy one."



Brunswick, ME 04011
207-725-3100

- ▽ 4-year private coed college
- ▽ Campus in a small town near the coast
- ▽ Full-time undergraduate enrollment 2001-02: 878 men; 880 women.
- ▽ Special features: Coastal Studies Center, Kent Island biological field station off the coast of Nova Scotia.

➤ "Sometimes I minded the isolation and the limited diversity, but my main gripe is that Bowdoin is unheard of on the West Coast. People can't even pronounce the name! Its name recognition is not equivalent to that of some other liberal arts colleges like Amherst and Wellesley."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Bowdoin?

➤ "Many kinds of people thrive here. Bowdoin tends to attract individuals who enjoy intellectual rigor combined with a laid-back environment. The students who are happiest here seem to be people who are active and outdoorsy, enjoy forming strong bonds with professors and fellow students, enjoy charting their own course, are confident in their individuality, and value and appreciate the unparalleled beauty of Maine."

➤ "People who are intellectually curious but not pompous, who want to take the time to grow, experience, look inward and outward. It's also great for people who have spent their lives in big cities and want to see another way of life. And for those who want to feel like a part of the community—no one is just a number."

If You Had It to Do over Again, Would You Go to Bowdoin?

All but three reviewers said yes.

➤ "Absolutely. In every job, academic pursuit, or other experience I have had since leaving Bowdoin, I have hoped to find the same level of academic challenge and reward I found at Bowdoin. Sadly, I have not yet done so. Bowdoin is an extraordinary place and I feel privileged to have spent four wonderful years there."

➤ "Definitely. My years there were among the richest and most enjoyable of my life. Maine is a great state that most students fall in love with. Students have the chance of a lifetime to get an excellent education *and* enjoy the beauty of Maine. As a Californian, I can attest that winters in Brunswick really aren't that bad. So don't let the cold scare you off from a college that offers a beautiful setting, wonderful teachers, engaged classmates, and a great quality of life."

➤ "I would not trade my experience at Bowdoin for anything in the world; but knowing what I do now, I would consider a more diverse school."

➤ "From a career standpoint, no. I would have gone to an engineering school. I enjoyed my four years at Bowdoin very much and made lifelong friends, but Bowdoin is not the best place for an aspiring engineer."

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

Book Editor

Interview with Betsy Lerner

by Melissa Hartman

Over the course of her publishing career, Betsy Lerner rose from an intern at Simon & Schuster to executive editor at Doubleday. This year, after 13 years as an editor, Ms. Lerner began working as a literary agent for the Gernert Company in New York. She is also author of *The Forest for the Trees: An Editor's Advice to Writers*.

Did you always know that you would work with books?

I never dreamed that I would have the chance to work with books. Growing up, I felt that books were somehow sacred. I didn't know about the publishing world, and, to tell you the truth, I thought most authors were dead. I didn't understand that it was a potential career until much later.

When did you get interested in publishing?

I majored in English in college but had no idea what I was going to do with my degree. In the spring of my senior year, I thought about applying to graduate school, but it was too late.

Publishing seemed like a logical choice for an English major. But when I tried to get a publishing job after college, I couldn't pass the typing tests. I took a crash typing course but still couldn't pass the tests. I ended up taking the first job I was offered, in the research library at an investment bank. It paid extremely well, but it wasn't a satisfying environment for me. So I took some writing workshops during that time, and eventually I applied to graduate school for writing.

While in graduate school, I worked part-time as an assistant at a literary agency, and that's when I realized that I could have a career working with authors and books. That's when I caught the bug.

What kind of work did you do at the literary agency?

I did a lot of typing and filing, and I liaisoned with authors. I loved all of it. I read everything and soaked it all up. The letters from the senior agents to the authors were so fascinating to me, and I became completely immersed in the world of publishing and writers. I don't know anyone who ever filed as eagerly as I did. It was a great way to learn the business.

Eventually I was asked to read. I would read manuscripts, write reader's reports, and recommend books that I thought we should represent to my boss.

Where did you go next?

In my second year of graduate school, I won a fellowship at Simon & Schuster. That program awarded money for graduate school, plus a paid internship for one year after graduation.

Like assistants everywhere, I did a lot of xeroxing, typing, and filing. I also did a lot of author hand-holding, a lot of running around trying to get contracts, trying to get books into production. Working there gave me a great understanding of the process.

I also learned a lot from just *being* there—being in the hall, meeting other editorial assistants, socializing. I used to play Scrabble every Wednesday night with two other editorial assistants, and we'd talk about what was being sold, what writer was a phony, what writer was brilliant. Those Wednesday nights were fantastic for me because I felt part of a community. I had worked and gone to grad school, so I was older than most editorial assistants. Most are 22 or 23, right out of college. I was 28, and I felt very self-conscious about my age.

How long did you work as an assistant before you became an editor?

I was an assistant for about a year, which is short. Most people are assistants for about three years before getting promoted to assistant editor or associate editor. The duties of that position are pretty much the same—you're still an assistant. But you do more editing for the editor you work for, and you try to acquire books at that point.

How do editors acquire books?

Most editors have contacts with agents who send them books, and the editors decide if they want to acquire them or not. But when you're an assistant, the way to acquire books is to be very industrious, to go to readings, to read literary magazines that the whole world isn't reading. The whole world reads *The New Yorker*, so you're not going to discover a writer in *The New Yorker*. But you might discover a writer in the *Yale Review* or the *Missouri Review*.

And you should check out the hot new magazines and hot new Web sites—all the things you and people your age are interested in. The publishing world needs books for every generation. So just by using your cultural antennae, you might bring tomorrow's stars to the publishing world.

An acquisition can start with something as simple as a fan letter, telling the author you read his or her story and thought it was brilliant. And you have access to free books when you're in publishing, so you can send authors you're courting a book you think they might like and ask them to keep in touch with you. You don't get a response every time, but that's how you build a network of potential authors.

Did you acquire any books as an assistant editor?

Yes, a lot of books. I worked at Ballantine, a paperback house, and we used to acquire paperback rights from hardcover publishers. I asked my boss if I could cover the university presses. Nobody was doing that, and there were some interesting books coming out of that world. I acquired paperback rights to quite a few of them.

My big break was acquiring a novel called *Rush* by Kim Wozencraft, a woman with whom I went to writing school. I also signed up one of my favorite writers of all time, Kate Braverman, who hadn't published a book in about 12 years. It was a very exciting time. I was in the right place, the authors were ready, and it all came together.

When did you become a full editor?

After about 15 months, which is fast. But I think everything was accelerated for me for a few reasons—I was older than most assistants, I had a degree in writing, I knew a lot of writers, I had worked at an agency. And I was ambitious as all get-out. I never wanted anything so much in my life as to become an editor in publishing. It was all I did. I would read all weekend long. I went to parties and I networked, but really my life became the publishing world, which isn't necessarily healthy.

How many books does an editor work on at a time?

As an editor, you're probably editing five to eight books per season. At any one time you're editing a few books, acquiring a few books, putting a couple of books into production. It's really a three-ring circus; you're never doing just one kind of job.

What qualities are important for an editor to have?

You need courage. If you read something and you think it's fantastic, you have to be willing to go out on a limb. And you have to be prepared to get shot down. You might love a book but be unable to make the editorial board see it the same way you do. But you have to have the courage to stand up for the ones you think are great.

An Editor's Advice to Writers

The Forest for the Trees

Betsy Lerner

You also have to be able to get along with people. It's a very social job—you have to work with many different kinds of people, from agents and authors to everyone in the company, from publicity to sales. As an editor, you have lunch almost every day of the week with an agent. At night you go to readings and publishing parties. It's hard to succeed in this business without a good network. If you're not comfortable with people, this probably isn't the job for you.

Finally, you have to remember that publishing is big business. If you're not interested in the money-making aspect of it, you should consider working for a university press or a nonprofit organization.

How did you learn to trust your judgment about what is good?

Experience. When I was editing the literary magazine in grad school, the editorial board almost always loved the poems that I thought were original and interesting, which was a very positive reinforcing experience. Bringing *Rush* to Ballantine and then seeing the author get a million-dollar movie deal was also very reinforcing. When you work with an editor and go through the process of acquiring and publishing books, you either gain confidence and feel that you've got something to contribute, or you don't, and you go on to another career. A lot of assistant editors end up in law school. It's very hard to break through.

When I worked at the literary agency, I had no courage. I would write very serious reports about books I thought were terrible because I didn't think I had the authority to say they were terrible. It took me years to gain the confidence to say "this is good" or "this is not good." Now, it's not a question of good or not good; now I ask, is this for me or is this not for me? Do I know how to publish this? I could have a great book in my hands—maybe the next thriller by Scott Turow—and not know it's good because I don't read thrillers; they're not my interest. I like serious nonfiction for the most part. I love memoirs, narrative non-fiction, psychology, women's studies. I have handled very few novels.

How do you know when you read something that it's something you want to work on?

It's absolutely visceral. My heart starts to race a little bit, I start to sweat a little bit. It's very much a physical reaction. It's like love at first sight.

Can you tell me about a book that was particularly satisfying to work on?

There are several: *Prozac Nation* by Elizabeth Wurtzel, *Autobiography of a Face* by Lucy Grealy. Both of those were books that I thought could really change lives. I also loved working on Rosemary Mahoney's memoir of her sixteenth summer with Lillian Hellman, *A Likely Story*. It's one of the best coming-of-age books I've ever read—especially if you want to be a writer. Another book I feel very proud of is *Little Girls in Pretty Boxes* by Joan Ryan, which is an expose of gymnastics and figure skating. That book got the Olympic Committee to change some of its criteria for gymnasts. That was a truly positive change in the world—brought about by a book I worked on.

I just did a book as an agent called *Augusta, Gone*. It's a mother's story about her 15-year-old who becomes very difficult and runs away, and the mother sends her to a wilderness camp. I've never had a response like this to a book. Parents and colleagues and people in my town have come up to me and said, I saw your name in the acknowledgments, I couldn't put it down, I loved it, I told all my friends about it. It has been completely gratifying.

Do you work with most of your authors in person?

Not if they're not from New York. You can work with someone for a long time without actually meeting them. But I'm very close with my authors and clients, and I think most editors and agents are. Going through the process of publishing a book is a very bonding experience. For example, I worked with Kim Wozencraft not only on *Rush* but also on her next two books. We're very close—I'm the godmother of her children. Now I'm her agent and just sold her new book.

What made you decide to become an agent?

I started writing again, and I wanted more freedom to do that. I have a daughter, and I wanted more freedom with my time. Finally, I wanted more freedom with the kinds of writers I could work with. At every publishing house, I had to go through so many approvals before I could acquire a book that it was getting more difficult for me to do the quirky publishing I like. As an agent, I get to choose what I want to work on.

What can students do now who are interested in publishing?

Working in a bookstore is a fantastic experience and people in publishing are always impressed by it. The person in the bookstore really sees where the rubber hits the road, what the consumers are buying and why, how books are actually sold, and why they appeal to people.

You can also learn a lot about the publishing world online. There are many great Web sites—like inside.com, publishersweekly.com, and publisherslunch.com—that make it possible to follow the publishing world and even look for jobs.

As for getting into publishing, I would like to see young people start creating their own publishing companies. I would like to see them use their gifts and talents to shake publishing up a bit. This is a pretty stodgy business that really needs the creativity, charisma, and excitement of young people. ■

More About ... Cepheid

Q	U	A	S	A	R	■	C	L	O	G	■	R	O	W
E	S	P	A	N	A	■	N	A	S	A	■	E	C	O
D	A	R	N	I	T	■	S	W	A	N	■	S	U	B
■	■	■	■	M	E	D	■	S	K	Y	■	O	L	B
P	L	E	I	A	D	E	S	■	A	M	O	R	A	L
R	I	G	E	L	■	L	A	G	■	E	N	T	R	E
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M	E	S	■	N	A	G	■	L	E	E	■	S	A	P
■	■	■	C	E	P	H	E	I	D	■	T	E	L	E
S	N	A	F	U	■	T	A	L	■	A	S	T	I	R
P	I	L	O	T	S	■	R	E	D	S	H	I	F	T
I	C	O	■	R	A	W	■	O	E	P	■	■	■	■
R	O	N	■	I	V	A	N	■	M	I	R	R	O	R
A	L	S	■	N	O	V	A	■	O	R	I	G	I	N
L	E	O	■	O	R	E	S	■	N	E	B	U	L	A

How do astronomers know how far away a star is? How do they estimate interstellar distances? This fundamental problem was solved in 1912 by Henrietta Leavitt, who was studying Cepheid variable stars. She discovered that the period of a Cepheid's fluctuation in brightness is highly regular and is proportional to its absolute luminosity. Since a Cepheid's absolute magnitude can be estimated from its period, its distance can be computed by comparing its absolute and apparent (measured) magnitudes. Found throughout the universe, Cepheids allow astronomers to estimate the distances to the galaxies in which they occur.

Meet your 2001-02

Readers Panel

Last year, we introduced our first Readers Panel, hoping to give students a way to shape Imagine into an even more useful and interesting publication. Those panelists gave us valuable feedback on each issue and also offered some great story ideas. We're thrilled to announce this year's panelists, some of whom have already made significant contributions to Imagine. You will hear more from them in upcoming issues.

But we also want to hear from you! If would like to share your ideas with our editorial staff, write to Melissa Hartman at mhartman@jhu.edu or CTY/Imagine, The Johns Hopkins University, 3400 N. Charles Street, Baltimore, MD 21218.

Senior Panelists

These panelists made exceptional contributions to last year's Readers Panel. We look forward to working with them again.

Jeremy Stoller is a junior at Albany High School in New York. Jeremy enjoys acting, writing, tap dancing, and playing piano. He has a black belt in Tae Kwon Do and loves listening to the music of Stephen Sondheim. He plans to pursue a career in playwriting, his main passion.

Shengping "Shelby" Yu is a senior at River Hill High School in Maryland. Shelby is the activities coordinator of the Howard County Association of Student Councils, the captain of her school's math team, and the editor-in-chief of the school literary magazine. She plans to double major in electrical engineering and economics in college.

New Panelists

Kathleen Bachynski is a junior at Groves High School in Michigan, where she plays oboe in the wind ensemble, tenor sax in jazz band, and cymbals in marching band. She is also a member of the Metropolitan Youth Symphony. She plays soccer competitively and volunteers as a teacher assistant at her church.

Jonas Budris is a senior at the Martha's Vineyard Regional High School in Massachusetts, where he sings in the chorale and plays clarinet and saxophone in the concert and jazz bands and orchestra. He also sings tenor with The Tanglewood Festival Chorus and The Boston Symphony Orchestra.

Elspeth Iralu is a homeschooled ninth grader from New Mexico. She enjoys ballet and has participated in the Gallup Performing Arts Academy, whose productions use drama and dance to tackle social issues. She plays classical piano and enjoys jazz, natural history, and nature photography. She won the 2001 Young Naturalist Award for her essay, "Nesting Habits of the Barn Swallow."

Patrick Mihelich is a sophomore at Park Tudor School in Indiana. He enjoys reading, playing Ultimate Frisbee and ping-pong, and juggling. He works at the city library in the Lego Mindstorms section, teaching area youth how to make and program simple robots. Patrick takes college classes in mathematics and this past summer was a junior counselor at the Ross Young Scholars Program. Read more about Patrick and his interest in chess on page 24.

Jeremy Stoller

Shelby Yu

Kathleen Bachynski

Jonas Budris

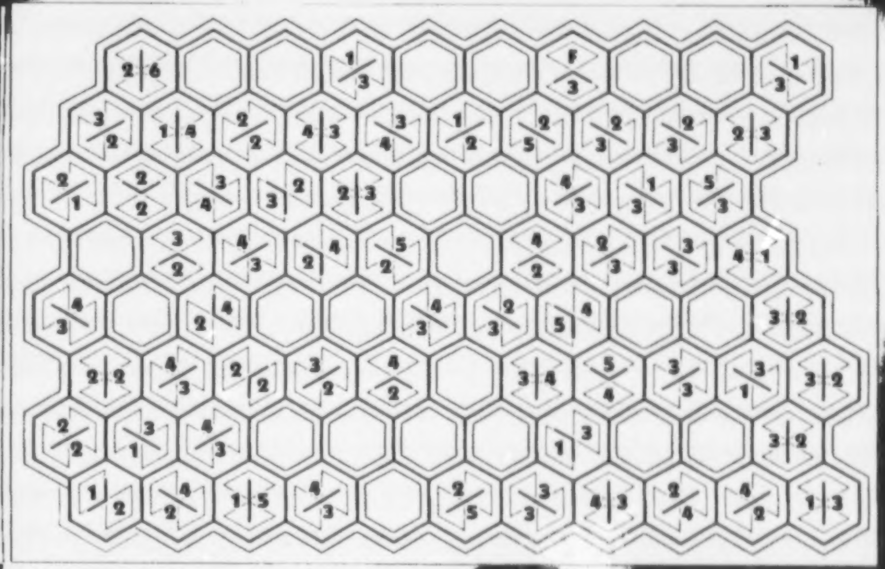
Elspeth Iralu

Patrick Mihelich

BEST COPY AVAILABLE

Knossos Games

by Tim Boester



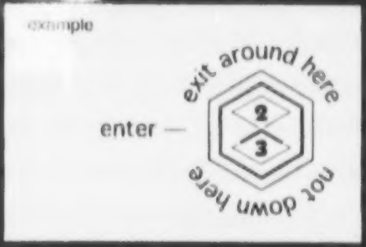
The Goal:
Start at the hexagon outlined in yellow and finish at the F.

The Rules:
You must exit a hexagon on the same side of the solid center line that you enter. (See example.)

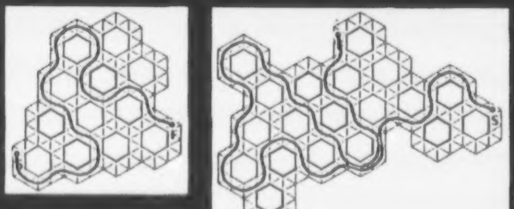
The number in the hexagon indicates the number of steps you must make in your next move. Use the number on the same side of the solid center line as your entry point; ignore the number on the opposite side of the line.

Each move must travel in a straight line; no dogleg or zigzag moves allowed. Ignore the lines and numbers inside the hexagons you jump over.

You may jump over but cannot land on the blank hexagons. All hexagons, including blank ones, count in computing jumps.



Solution to Knossos Games in our September/ October issue:

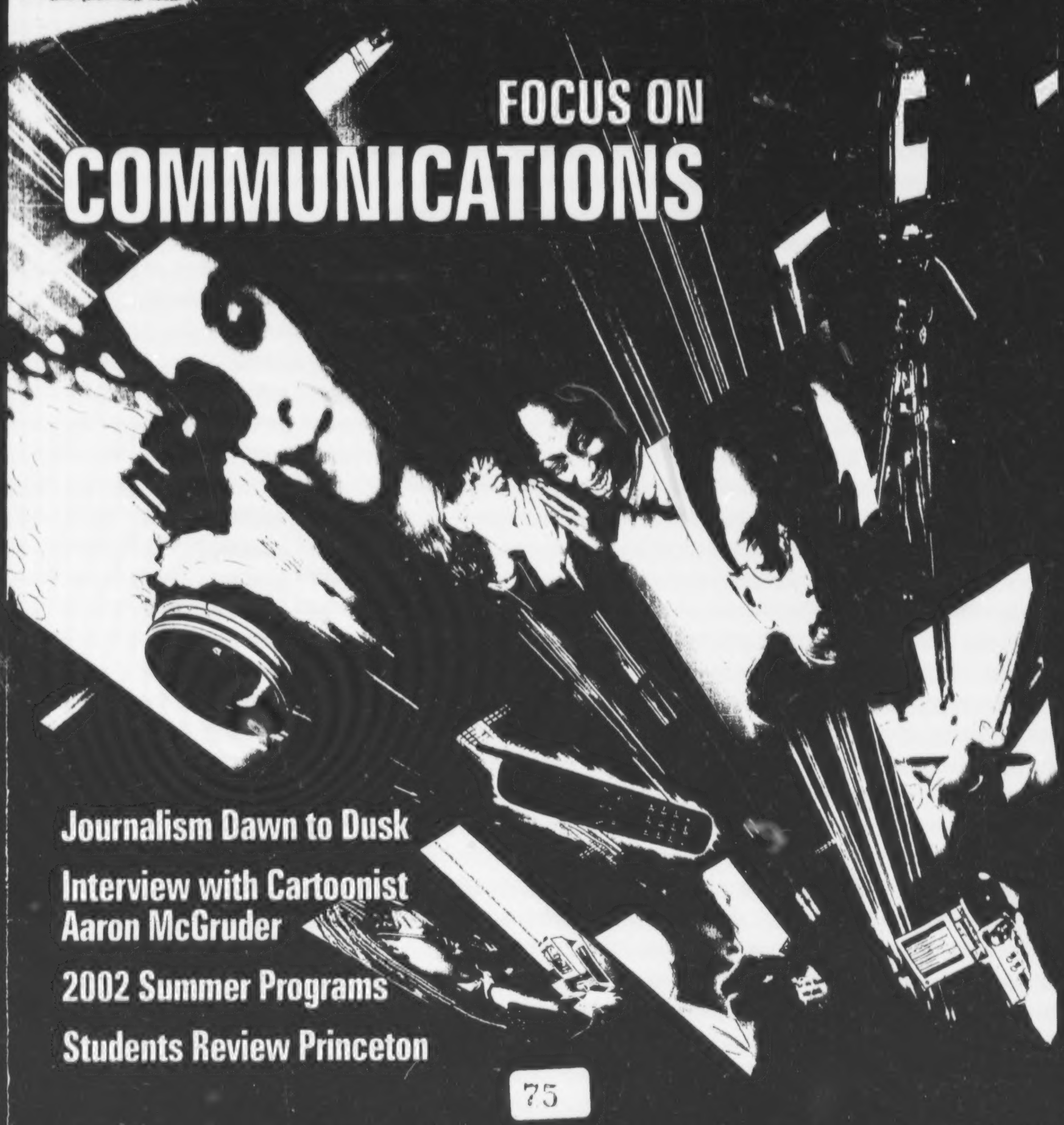


A graduate student in educational psychology at the University of Wisconsin, ***Tim Boester*** now has additional puzzles on his home page: http://homepage.mac.com/boester

imagine...

JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

OPPORTUNITIES AND RESOURCES FOR ACADEMICALLY TALENTED YOUTH Volume 9 Number 3 • January/February 2002



FOCUS ON COMMUNICATIONS

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Interview with Cartoonist Aaron McGruder

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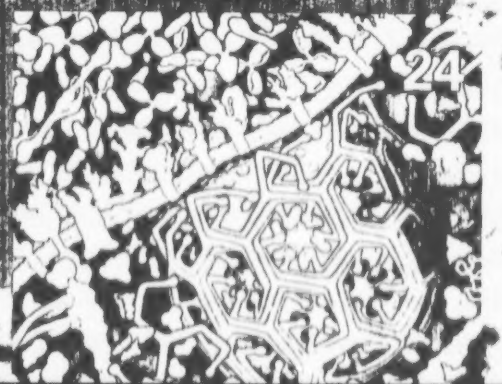

ImaGiNe...

Opportunities and Resources for Academically Talented Youth*

ISSN 1071-605X Volume 9 • Number 3
January/February 2002

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Published five times a year—September/October, November/December, January/February, March/April, and May/June.

Periodicals Postage paid at Baltimore, MD, and additional mailing offices.

POSTMASTER: Send address changes to *Imagine*,
P.O. Box 3073, Langhorne, PA 19047.

Imagine is published by the Study of Exceptional Talent (SET) at The Johns Hopkins University Center for Talented Youth.

Editor	**Melissa Hartman**
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Designer	**Steve Kelly-Judd/Tempest Design Group**

Annual subscription: $25.00
Institutions: $30.00

Address subscription inquiries to:
Imagine
P.O. Box 3073, Langhorne, PA 19047
(215) 826-0707 • fax: (215) 788-6887
or order online at www.jhu.edu/gifted/imagine

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STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION, 10/8/01

Title: Imagine. Pub. No. 1071-605X. Frequency: Sept./Oct., Nov./Dec., Jan./Feb., Mar./Apr., May/June. Five issues published annually. Subscription price: $25.00. Location of office of publication: SET/CTY, 2701 North Charles Street, Baltimore, MD 21218. Headquarters of publishers: SET/CTY, The Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218. Editor: Melissa E. Hartman, SET/CTY, The Johns Hopkins University, Baltimore, MD 21218. Owner: The Johns Hopkins University, Baltimore, MD 21218. The purpose, function, and nonprofit status of this organization and the exempt status for Federal income tax purposes have not changed during the preceding 12 months.

Extent and nature of circulation	Avg. no. copies each issue preceding 12 mos.	Actual no. copies single issue pub. nearest to filing date
A. Total no. copies printed	9000	9000
C. Total paid/requested circulation	6754	6615
F. Total free distribution	1311	950
G. Total distribution	8065	7565
H. Copies not distributed	935	1435
I. Total	9000	9000

I certify that the statements made by me above are correct and complete. Melissa E. Hartman, Editor.

To Communicate is Human

In the movie *Cast Away*, Chuck Noland (played by Tom Hanks) is stranded on a deserted island. To survive physically, he needs food, water, shelter, and fire. But physical survival is only part of the story. To survive mentally and emotionally, he needs a friend, which he finds in Wilson, a volleyball that washes ashore.

The relationship between Chuck and Wilson reveals just how integral communication is to human existence and how ingrained it is in our nature. Humans are social; we live among other people and communicate not only to survive, but to thrive. When we are separated from other people for some length of time, our instincts will have us looking for someone—or something—to communicate with.

But we live in an age when we are rarely separated from other people: e-mail, instant messaging, chat rooms, and video conferencing bring us together no matter how physically distant we are. And even more conventional media—books, newspapers, television, and radio (not to mention their online counterparts)—let us share our ideas with other people from a distance. We are more connected than we have ever been.

In this issue of ***Imagine***, we explore these connections from the communicator's point of view. Student journalists and broadcasters discuss the skills they're using to create effective newspapers, yearbooks, television segments, and radio programs. A professional cartoonist talks about how he's pushing the boundaries of the comics page to get people talking about race and other complex subjects. A graduate student at the MIT Media Lab describes some media of the future that could change the way we view—and create—movies, while a multimedia developer discusses the future of the written word in the digital age.

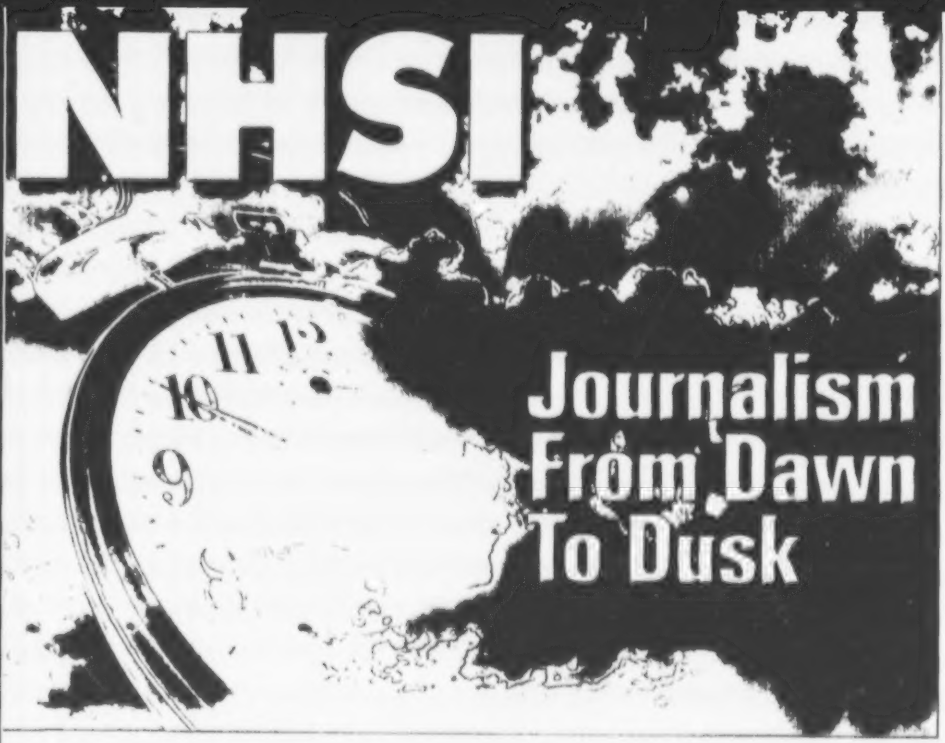
All of these articles might make Chuck Noland's situation seem even more unthinkable. But they will also make Wilson seem that much more important. After all, the drive and desire to communicate is what has gotten us to this age of extreme connectedness. So if you're ready to get connected, read on.

Imagine Wins a 2001 Parents' Choice Award

This fall, ***Imagine*** was one of only five magazines, including National Geographic's ***World*** and Scientific American's ***Explorations***, to win a prestigious Parents' Choice Award. Parents' Choice Foundation awards its seal of approval to "products that meet and exceed standards set by educators, scientists, performing artists, librarians, parents, and yes, kids themselves. The Foundation's purpose is to search out and recommend fairly priced products that help kids grow—imaginatively, physically, morally and mentally—and that are fun, safe, and socially sound." For more information visit www.parents-choice.org

NHSI

Journalism From Dawn To Dusk



by Gavin Myers

The Sunday welcome dinner ends, and a deluge of 86 students pours into the Fisk Hall auditorium of Northwestern University's Medill School of Journalism. I take a seat near the back and look down at my schedule: "7:15 p.m.: Work on assignments; due at 9:30 p.m." I begin to wonder whether my decision to enroll in the National High School Institute's Journalism Division was a good one. I love journalism—that is why I am spending five weeks away from home studying it—but could the schedule be correct? Is there really a story due the first night of the program, one day before classes officially begin?

And the answer is yes. Each of us would conduct an interview with another student and then write a two-page profile ... in just over two hours.

By the time I completed my article, it was 9:00. I returned to my dorm feeling that I was on my way to becoming a true journalist. I had completed my first NHSI-J story.

Joining the Writers' Circle

I had become interested in journalism less than a year earlier, at the beginning of my junior year. I saw a sign asking for staff writers for my school's newspaper, *The Senator*. I had no idea what I was I getting myself into, but I knew one thing: I loved to write.

At the staff's first meeting, our newspaper adviser told us to gather in a circle. In front of the rest of the newspaper staff, we each had to name three things we liked and three things we disliked about one of last year's issues. When the adviser called on me, I was nearly speechless. I knew *nothing* about journalism.

As the year progressed, and as I wrote news and feature articles, I began understanding journalism slightly more. When I won some awards in the spring from the Eastern and Southern Illinois High School Press Associations, I began considering journalism as a possible career. I wanted to learn as much as I could, so I applied and was accepted to the NHSI-Journalism Division.

In my dorm at NHSI, I thought about how far I had come in my few months as a journalist. Maybe I could go even further.

Writing, Writing, and Rewriting

The pace at Medill was exciting but also exhausting. Every day from 9:00 a.m. until 9:00 p.m., I attended lectures, workshops, and labs; interviewed Evanston-area citizens; and wrote stories.

Many articles were due just an hour after they were assigned. On my high school newspaper, we usually had at least a week to compose stories. However, at Medill, meeting deadlines was paramount. I soon adapted to the fast pace by putting the essentials of a news story down on paper first and then considering my diction and syntax if time permitted.

We also learned about revision, particularly in an activity called "Rotating Rewrites." The project started with a news briefing, where we learned information such as places, names, dates, and the people involved with three previously published news stories. Our task was to write a lead for each story that duplicated those printed in the newspaper. The difficulty was that we wouldn't be allowed to see the printed leads.

I began extracting the most essential information from the loads of information given. Then, using the old Smith Corona word processors, I typed my first lead. When I took it to one of the instructors for approval, she simply said, "nope."

It wasn't until my ninth try that the instructor silently drew a happy face and told me to go onto the next lead. Two

Gavin Myers with Medill–NHSI instructor Ashli Sims

hours later, I had written three leads, each of which had anywhere from six to ten versions. At first glance it might seem a waste to spend two hours writing four or five sentences, but I did feel a strong sense of accomplishment after successfully writing three leads to "publication specifications."

Wanted: Criticism

Every week I anticipated meetings with my instructor, Ashli Sims, a 2001 graduate of Medill, to discuss the strengths and weaknesses of my writing.

When Ashli returned my first stack of papers, I was stunned by the pink markings that covered almost every line of all my papers. I left that first meeting in a daze. Were my articles really that bad?

After the shock wore off, I began to realize the value of these criticisms. I studied exactly what I had done wrong, and I corrected those mistakes in my subsequent articles. For me, criticism soon became the single most essential aspect of the entire program. I realized that only by understanding and correcting my mistakes could I become a better journalist.

Learning from the Pros

The weeks flew past. For the most part, Medill professors or instructors lectured during the morning, while labs and assignments filled the afternoons. Although all the instructors in the program were Medill graduates, each had a unique sphere of interest. From Carol Honsa, the ex-foreign correspondent to the Indian subcontinent, to Bret Begun, a Periscope editor for *Newsweek*, to Keith Carter, the sports broadcast reporter, all of the important bases of journalism were covered.

We also attended workshops designed to let us explore areas of journalism we didn't know much about. One of the best workshops I attended focused on narrative storytelling. In this workshop, Kirsten Scharnberg of the *Chicago Tribune* emphasized the importance of observation in journalism. She thought that *all* stories in a newspaper could and should be told in the narrative format.

Before this workshop, I never conceived that journalism could have such a personal side; some of Kirsten's stories required months of reporting, during which she got to know her interview subjects on a first-name basis. Suddenly, I realized that feature writing wasn't just for magazines; I could enjoy the best of both worlds by writing features for a newspaper.

We also saw journalism in practice through various trips to media outlets. My favorite field trip was to the *Chicago Tribune*, where the editor, Ann Marie Lipinski, spoke with us about her duties. Later in the day, we toured the newsroom and saw firsthand the inner workings of a major media center.

When the program ended at Medill, it was time to put what I'd learned into practice at my high school newspaper.

August 30 rolled around, and I entered school energized by the invigorating summer I had spent at Northwestern. A few days into school, my adviser gave her usual ice-breaking newspaper assignment: "Name three things you liked and three things you disliked about last March's issue."

The difference was that this time I was prepared. Very prepared. ■

Gavin Myers is a senior at Springfield High School in Springfield, IL. Editorial manager of the school paper and co-editor-in-chief of the school literary publication, Gavin also plays violin and volunteers for the Springfield Children's Museum.

SELECTED SUMMER PROGRAMS IN JOURNALISM

The following programs are only a few that offer journalism courses. Many more programs are offered at the state and regional levels. If you don't see your area represented, visit the students' section at http://djnewspaperfund.dowjones.com or go to http://highschooljournalism.org/students/jororg_index.cfm to contact journalism organizations in your state.

Indiana University High School Journalism Institute
Grades 9–11; five-day sessions in television news, yearbook, newspaper, business/advertising, and photojournalism. *High School Journalism Institute, Indiana University, Ernie Pyle Hall 200, 940 East 7th Street, Bloomington, IN 47405-7108; (812) 855-0895; www.journalism.indiana.edu/workshops/hsji/students.html*

Northwestern University National High School Institute–Journalism Division
Grade 11; five-week session includes courses on print and broadcast journalism. *NHSI–Journalism Division, Northwestern University, 617 Noyes, Evanston, IL 60208; (800) 662-6474; www.northwestern.edu/nhsi/main/journalism/journalism.html*

University of Florida Summer Journalism Institute
Grades 10–12; six-day sessions in newspaper, yearbook, photography, broadcasting, and Web design. *Summer Journalism Institute, 1000 Weimer Hall, The University of Florida, College of Journalism and Communications, P.O. Box 118400, Gainesville, FL 32611-8400; (352) 392-6558; www.jou.ufl.edu/pubs/sji/home.htm*

University of Iowa Summer Journalism Workshops
Grades 9–12; six-day sessions in yearbook, newspaper/newsmagazine, photography, Web site design, broadcast, and desktop publishing. *The University of Iowa, Summer Journalism Workshops, School of Journalism and Mass Communication, 303 Seashore Hall W, Iowa City, IA 52242-1528; (319) 335-3318; IHSPA@uiowa.edu; www.uiowa.edu/~provost/summer/journalism.htm*

University of Mississippi Journalism Institute
Grades 9–12; four-week course in college-level journalism. *Summer College for High School Students, 209 LaBauve, The University of Mississippi, University, MS 38677; (601) 232-7621; umsummer@olemiss.edu; www.olemiss.edu/depts/umsummer/SumCollege_Journalism2001.html*

Osmosis and Trial and Error

AN EDUCATION IN YEARBOOK

Over the years, Shawnee Mission North High School has won several awards—including Gold Crowns from the Columbia Scholastic Press Association and Yearbook Excellence Awards from Quill and Scroll—for their yearbook, the* Indian. *In this article, one of the* Indian*'s editors talks about how she and the rest of the staff learned their craft.

by Christina Sanabria

Because of a scheduling problem in the counseling office, I didn't start my yearbook class until a few weeks into my freshman year. When I arrived, finally, it was to a whirlwind. I introduced myself as a new writer to our teacher, Ms. Lucas, and she whisked me away to a corner where she stacked handouts on the basics of story writing and information on how much ad money I had to generate. She also handed me an assignment, the only one left: a two-page spread, 600 words, on volleyball.

Beth Jarvis and Yvonne Corpus sort through photos to accompany a student profile.

I was always a shy child. Now I was terrified. I didn't get to role-play selling ads to businesses or hear an extensive discussion on writing leads. But guess what? Neither did anyone else on the staff.

Learning by Doing

In Yearbook, we learn by osmosis and trial and error. My copy editor never told me what questions to ask during an interview or how to organize them. She did tell me to go watch the volleyball team practice—which I did, religiously, from the top row of the bleachers in the most remote corner of our Field House. And no one ever made me memorize the quick keys and their functions in QuarkXPress and Photoshop, but, because I learned them on my own as I needed them, I can now recite them in my sleep.

Somehow, despite unorthodox teaching methods, our staff produces an excellent yearbook. Or maybe it's *because* of the teaching methods. We learn by doing, which means that we need to retain everything we learn and learn nothing that we don't need. Judy, one of our ads editors, will never forget the resolution at which she needs to scan images because of her battle scars: the 15 images she had to rescan last year. Likewise, I've seen a photographer who used 30 sheets of paper on one print in September finalize a print in April in just three tries. And because we are not overwhelmed with what's "right" and "wrong," our instincts have a chance to show through.

***Indian* staff member Jeanel Drake adds final notes to the ladder, a diagram of all the pages in the yearbook.**

Getting out of the Box

At the end of freshman year, Ms. Lucas suggested that I apply for ads editor, a coveted position. I had won the "Rookie of the Year Award," which might have helped make me a good candidate.

But when I filled out the application, which asked about design experience, I realized that I had very little knowledge of design and even less of QuarkXPress, the graphics program we use to lay out the pages. When I expressed my concerns to Ms. Lucas, she replied, "Hmm ... You'll be okay."

In preparation for deadlines, Chris Perry, Jeanel Drake, Yvonne Corpus, and Carrie Rowe organize page envelopes by their level of completion.

I spent the year rebelling at the series of white-box, centered-text ads that filled the section. I started experimenting with borderless boxes and patterns.

I can now look at the ads section I created and point to the ad where I first thought to run text over a lightened part of a picture, the ad where I figured out how to change the tracking of text, and the several ads I had to do over because I used Chicago, a font that was off-limits for print production.

I can also point to the ads I think are the best, and the ones that I think are complete failures. There are more failures than bests. But maybe because I took a risk in designing, this year's editors have managed to turn the majority of the ads into bests.

Teaching, Not Telling

After spending a year designing 100 pages of ads, I realized that the contribution I was most proud of wasn't in the ads section. It was a profile I had written. I decided that writing, not design, was my forte. Ms. Lucas seemed to think so, too, and encouraged me to apply for copy editor.

This year, as copy editor, I put away my red editing pens—so that new writers wouldn't have to watch their hard work torn open and bleeding—and made it a point to give three positive comments on every paper ("Good transition!"). I reminded myself that they needed both criticism and encouragement if they were going to improve.

At some point I started giving feedback on proposed interview questions instead of just checking to see they existed. ("Jessica, what is the hardest part of yearbook?" "Uh, I dunno..." "That's right. And that's exactly what the golf player will say when you ask what the hardest part of golf is. Try rewording and make sure to lead up to it by...") I think constantly of the trials I passed as a freshman and try to devise ways to help the new writers avoid them. It makes me remember my copy editor's suggestion to watch a volleyball practice or two. Maybe she was trying to do the same for me.

But when one writer asked me bluntly for the transition she should use, I had to draw the line. Now I don't tell them that the proper convention for *ante meridian* is *a.m.*; I just point to the AP style books and raise my eyebrows.

Likewise, I walk the organizations editor through eliminating a picture's runaround, but I resist the urge to take over the mouse. I must. That's the only way they'll learn. ■

Christina Sanabria is a junior at Shawnee Mission North, where she plays varsity tennis and is active in her school's environmental club.

COMPETITIONS FOR STUDENT PUBLICATIONS

American Scholastic Press Association
Elementary, middle, and high schools submit yearbooks, magazines, and newspapers to this contest, in which all entries receive first-, second-, or third-place awards in their category. *ASPA, P.O. Box 4400, College Point, NY 11356; asa@asan.com; www.asan.com/asa/aspa1.htm*

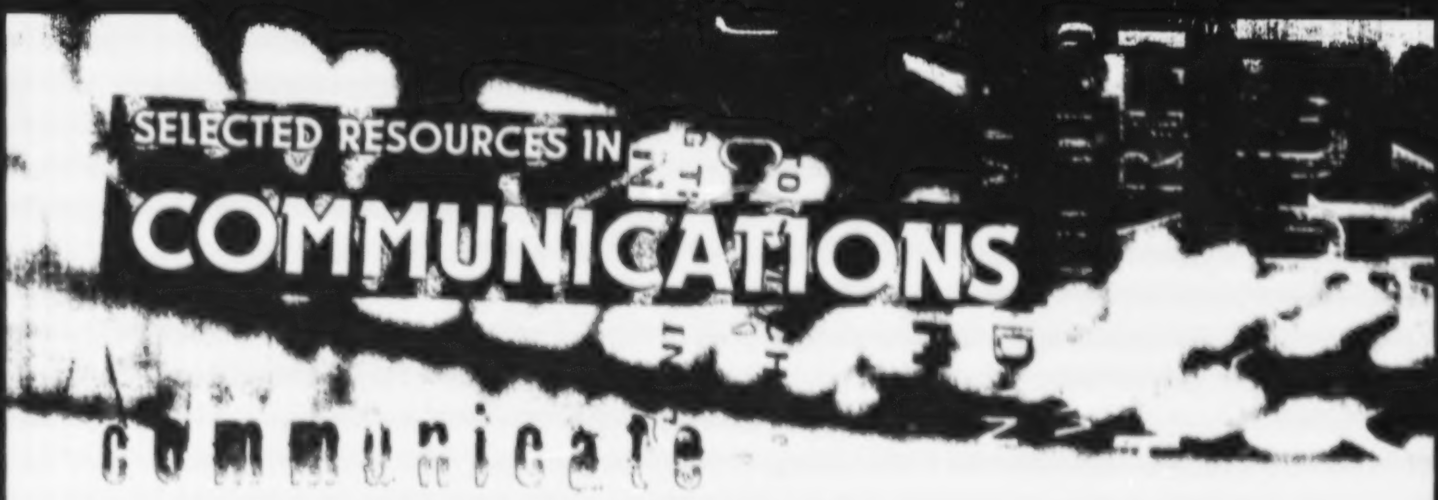
AEP Student Publishing Awards
Elementary, middle, and high schools enter online, video, or print newspapers, literary magazines, and yearbooks. Winning schools in each category win cash, educational materials, and a visit from a professional editor or art director. *Association of Educational Publishers, 510 Heron Drive, Suite 309, Logan Township, NJ 08085; (856) 241-7772; mail@edpress.org; www.edpress.org*

Columbia Scholastic Press Association Awards
Middle schools and high schools that are members of CSPA submit newspapers, yearbooks, and magazines for judging in the Scholastic Crown Awards. Individual high school students may also submit to the Gold Circle Awards, a separate contest also offered by CSPA. *CSPA, Columbia University, Mail Code 5711, New York, NY 10027-6902; (212) 854-9400; cspa@columbia.edu; www.columbia.edu/cu/cspa*

NCTE Program to Recognize Excellence in Student Literary Magazines
Middle schools and high schools enter literary magazines to be ranked against entries from the U.S., Canada, and U.S. schools abroad. *PRESLM, National Council of Teachers of English, 1111 W. Kenyon Road, Urbana, Il 61801-1096; www.ncte.org/grants/magazine.shtml*

National Scholastic Press Association Contests
Middle schools and high schools that are NSPA members compete for Pacemaker Awards, which honor exceptional yearbooks, newspapers, Web publications, magazines, and television broadcasts. NSPA also offers several contests for individual journalists, including the Courage in Student Journalism Awards. *NSPA, Associated Collegiate Press, 2221 University Avenue SE, Suite 121, Minneapolis, MN 55414; (612) 625-8335; www.studentpress.org/NSPA/contests.html*

Quill and Scroll Yearbook Excellence Contest
High school students who are contributors to or staff members of a student yearbook at any school that is a charter member of Quill and Scroll Society may enter. Awards are made in 12 divisions; winning seniors are also eligible to apply for one of the $500 Edward J. Nell Memorial Scholarships in Journalism. *Quill and Scroll Society, School of Journalism, The University of Iowa, Iowa City, IA 52242; (319) 335-5795; quillscroll@uiowa.edu; www.uiowa.edu/~quillsc/*



SELECTED RESOURCES IN COMMUNICATIONS

COMPETITIONS

You can link to these and other contests from our Web site at www.jhu.edu/gifted/imagine. Also visit www.studentcontests.com to search for contests in a variety of disciplines.

Amazing Kids! Cartoon Contest

Students ages 6–17 submit cartoon strips; winners receive art-related prizes and mentorships with professional cartoonists. **Deadline**: December 15. *Amazing Kids!, 1158 26th Street PMB 485, Santa Monica, CA 90403; (310) 514-9203; info@amazing-kids.org; www.amazing-kids.org*

American Legion National Oratorical Contest

Students in grades 9–12 present a 3–5-minute speech on an assigned topic. National 1st-, 2nd- and 3rd-place winners receive scholarship awards of $18,000, $16,000, and $14,000, respectively. **Deadline**: For local deadlines, contact your local American Legion office. *acy@legion.org; www.legion.org/events/evt_oratorical.htm*

And Now a Word from Our Planet

Students in grades 6–12 submit radio ads. First-place winners in each age category win $1,000; second-place winners receive $500. Winning entries are professionally produced to air on radio stations. **Deadline**: February 15. *PopEd@zpg.org; www.awordfromourplanet.org*

David S. Barr Award

One high school journalist who either broadcast or published a piece between Jan. 1, 2001, and Dec. 31, 2001, that helped right a wrong, corrected an injustice, or promoted justice and fairness will win $500 for his or her work. **Deadline**: January 25. *David S. Barr Award, The Newspaper Guild–CWA, 501 Third Street NW, 2nd floor, Washington, DC 20001-2797; (202) 434-7177; www.newsguild.org/awards/barr.php*

Ernest Hemingway Writing Awards

High schools enter submissions by two students in feature writing, news writing, sports writing, and commentary. Submissions must have appeared in a student publication in the previous school year. First-place winners receive $2,500 and a trip to Kansas City for an awards banquet. **Deadline**: January 15. *Lisa Lopez, Hemingway Awards, The Kansas City Star, 1729 Grand Boulevard, Kansas City, MO 64108; (816) 234-4907; www.kcstar.com/aboutstar/hemingway/hem2.htm*

International Student Media Festival

Students in kindergarten through college, as individuals or members of a team, class, or club, submit productions in one of five categories: live action, sequential stills, animation, multimedia, or Web site. Winning entries are shown at the AECT convention, where winners receive their awards. *John & Marilyn Connelly, Kalaheo CommArts Learning Center, 730 Iliaina Street, Kailua, HI 96734; (808) 254-7912; connelly@hits.net OR Robert Utt, St. Charles High School, Kings Highway and Waverly, St. Charles, MO 63301; (636) 724-3940 ext. 147; rutt@mail.stcharles.k12.mo.us; www.aect.org/ISMF*

National Federation of Press Women High School Communications Contest

Students in grades 9–12 enter submissions to their state contests in editorial, feature, review, news, sports, column, feature photo, cartooning, single page layout, or graphics categories. National awards in each category include cash, certificates, and plaques. **Deadline**: State deadlines are in early February. *NFPW, P.O. Box 5556, Arlington, VA 22205; (800) 780-2715; presswomen@aol.com; www.nfpw.org/youth/youth_index.htm*

Quill and Scroll Society International Writing, Photo Contest

Schools submit two entries in each of 10 categories: editorial, editorial cartoon, news story, feature story, in-depth reporting (individual and team), sports story, advertisement, and photography (news-feature and sports). **Deadline:** February 5. *Quill and Scroll, School of Journalism, University of Iowa, Iowa City, IA 52242; quill-scroll@uiowa.edu; www.uiowa.edu/~quill-sc/*

Scholastic Art and Writing Awards

Students in grades 7–12 submit entries in any of 8 writing and 16 art categories. Prizes include publishing opportunities and cash awards ranging from $100 to $5,000. **Deadline:** Contact your regional sponsor; some require submissions as early as November. *The Scholastic Art and Writing Awards, 555 Broadway, 4th Floor, New York, NY 10012; (212) 343-6493; GeneralInfo@Scholastic.com; www.scholastic.com/artandwriting/*

ThinkQuest Internet Challenge

Students ages 12–19 design educational Web sites as members of two- or three-person teams and submit an entry in one of five categories: Arts & Literature, Science & Mathematics, Social Sciences, Sports & Health, and Interdisciplinary. ThinkQuest Junior is offered for students in grades 4–6. **Deadline:** Proposals due by May 31; entries must be submitted by September 5. *Advanced Network & Services, Inc., 200 Business Park Drive, Armonk, NY 10504; (914) 765-1138; tq-help@advanced.org; www.thinkquest.org*

VFW National Competitions

To find out how you can participate in these contests in your area, call your local Veterans of Foreign Wars (VFW) office. Some details are available at www.vfw.org/yourtown/

Youth Essay Contest: 7th and 8th graders write essays on an annual theme. National prizes are savings bonds in amounts ranging from $1,000 to $10,000.

Voice of Democracy Contest: Students in grades 9–12 tape-record themselves reading an essay of 3–5 minutes that they wrote on an annual patriotic theme. Local winners receive an all-expenses-paid trip to Washington, DC, for the national judging, where they compete for a $25,000 scholarship.

PROFESSIONAL ORGANIZATIONS

Association of American Publishers

www.publishers.org

National Association of Broadcasters

www.nab.org

National Association of Science Writers

www.nasw.org

National Cartoonists Society

www.reuben.org/wannabe.asp

National Press Photographers Association

www.nppa.org

Society of Professional Journalists

http://spj.org

WEB SITES

About Graphic Design

http://graphicdesign.about.com/

About.com's graphic design page has links to everything an aspiring designer needs to get started and even get employed, from tutorials to listings of design schools.

CyberNewseum

www.newseum.org/cybernewseum/

Plan to spend a lot of time here—every section is filled with amazing photographs. Exhibits include Holocaust: The Untold Stories, The Berlin Wall, and Newseum Stories of the Century.

High School Journalism

http://highschooljournalism.org

Sponsored by the American Society of Newspaper Editors, this site offers everything from contest and scholarship information to chat rooms for journalists. Also offers links to all of the major journalism organizations.

Jobs Page: Your Link to Newspaper Careers

www.freep.com/jobspage/high/

Considering a career in journalism? Check out this site full of information on internships, scholarships, and ways to improve your journalism skills now.

Poynter's High School Journalism Guide

www.poynter.org/centerpiece/highschool/

Full of practical advice for high school reporters, editors, and broadcasters, this site covers topics including ethics and law, and has links to many useful resources.

If you think radio is just about spinning disks, you probably haven't visited a high school radio station. School stations give students the chance to have their voices heard on the air and also provide exposure to the more technical side of broadcasting. In this article, Paul Campbell explains how he has discovered a world of possibilities at C89.5 FM, his school's radio station.

The Story Behind the Sound

HIGH SCHOOL RADIO

by Paul Campbell

As I stepped into the studio and positioned the microphone, my heart beat with anticipation. I was just a nervous sophomore at Nathan Hale High School. But as the timer ticked down and the song came to an end, I became a DJ broadcasting to 80,000 listeners on C89.5 FM, home of Seattle's hottest music.

That was a year ago, during my first week in Advanced Radio at Nathan Hale. That day, I never would have believed that I would be playing music on the 5 p.m. to 8 p.m. Thursday shift while also juggling my duties as program director. Yet here I am, working at one of the most influential high school radio stations in the country—and thinking ahead to a career in radio.

Joining the Crew

To join Advanced Radio, students must first take Introduction to Radio, where they learn radio history and get a general introduction to what it's like to work at a radio station, but they don't actually go on the air. Then, when they join Advanced Radio, they must sign a contract agreeing to rules such as making it to class on time and following FCC regulations. Failure to follow the rules can mean not only removal from the class, but also, in some cases, station fines. For example, we could be fined by the FCC if someone swears on the air, if we fail to keep detailed logs every hour, or if we don't edit swear words from songs. Our budget is small, so FCC fines for even one person's mistakes could really hurt the station.

My first week in Advanced Radio was very hectic. One day I learned how to print out the station's legal logs, which contain details about public service announcements, underwriting credits, DJ time slots, and so forth. The next day I recorded a public service announcement (PSA), and the day after that I was on the air. I was taught so many things at once that it was hard to keep up. But I began to see how important every task is and how they all relate, and I felt that I was doing more than just school work. I was hooked.

I started off at Level 1, which means that the only on-air work I could do was read the news. Level 1 students don't introduce songs; they play only pre-recorded elements. Only after completing certain school requirements, such as recording a PSA, making station identifications, and reading the news over the air independently, can Level 1 students be promoted. For me, Level 1 was about observation. I learned a lot about radio just by watching students in Levels 2 and 3. Students at Level 2 can introduce songs, but they have to read exactly what's in the book (there is a page about what DJs can say for every song in the studio). The highest level attainable is

Level 3, which requires an on-air, three-hour shift after school, on weekends, or during lunch. Students at this level also can decide what to say on the air, as long as it's within FCC regulations.

The Whole Production

Students in Advanced Radio are also encouraged to do a segment for "C-trends," a student-run and -produced show that airs on Saturday mornings. Students pick their own topics, such as movie reviews or "what's hot, what's not," and then have a week to put together their segment. A couple of students are responsible for turning everyone's segments into a show.

My first segment, "Off the Kicker Wire," was fairly simple. I found some interesting stories from the newspaper, read them out loud a few times for practice, and then recorded them. But a later segment that I produced, "The Student Music Committee," was much more complex. First, I had to write and produce a promo for the show to get local artists to send in their music. When I started receiving CDs that I thought were appropriate to review (I received enough that the show ran for almost a whole semester), I would have students listen to the music and I would record their comments.

To do this segment, I needed to cut and paste between the song and the students' reviews, so it was essential for me to become familiar with our audio editing program, the "saw." An older student taught me how to use the program, which allows us to cut up sound files to do things like shorten a song, edit a swear word, or insert comments. It took me about a week to learn how to use the saw and a lot of practice before I was really good at it.

"The Student Music Committee" put my editing skills to the test. First, I would listen to all of the students' comments and try to pick out the ones that conveyed the general opinion of all the students. Then I would record the comments and the artist's song into the saw. I would introduce the song, play a little of it, and then play the students' comments on top of the rest of the song.

It might sound easy, but the process is actually pretty complicated. First, I would have to cut out the silence between the students' comments as well as all of the comments I wouldn't be using. I would then compress and equalize the remaining comments to make them sound louder and clearer. Once this was complete, I would begin the often tedious task of pasting the comments I intended to use over the song as well as adjusting the song's volume in order to prevent the song from drowning out the comments. This took up the bulk of my time—usually two or three hours to get it right—for the segment. But in the process I discovered that I have a knack for editing, which is probably why I'm now the production director.

Being the production director is the most challenging part of radio for me. Simply put, my job is to work with everything—from promos for new music and events to identification elements for the station—that needs to be edited in any way before going over the air. Aside from music, almost everything that we air needs some editing, so I spend most of my class time and much of time after school using the saw. However, the satisfaction of hearing something I've toiled over for hours played on air for the first time definitely makes it worthwhile.

The career possibilities opened by taking the radio class are numerous and run from the engineering side of radio to being a DJ or even a radio news reporter. I love both the production side of radio and the thrill of going on the air, so I'm not sure what area of radio I will go into. But I know that every day I am at the radio station is another day invested in my future. ■

On the Dial!

You can listen to these high school radio stations on the Internet.

1660 AM at Pueblo High Magnet School
in Tucson, AZ
http://edweb.tusd.k12.az.us/potterd

KASB 89.3 FM at Bellevue High School
in Bellevue, WA
www.bsdvoc.com/school/radiotv

WHJE 91.3 FM at Carmel High School
in Carmel, IN
www.whje.com

KNHC 89.5 FM at Nathan Hale High School
in Seattle, WA
www.c895fm.com

WMPH 91.7 FM at Mount Pleasant High School
in Wilmington, DE
www.wmph.org

KVHS 90.5 FM at Clayton Valley High School
in Concord, CA
www.kvhs.com

WNAS 88.1 FM at New Albany High School
in New Albany, IN
www.wnas.org

WAVM 91.7 FM at Maynard High School
in Maynard, MA
http://web.maynard.ma.us/wavm

WSDP 881. FM at Plymouth Salem High School
in Canton, MI
www.wsdpradio.com

Paul Campbell is a junior at Nathan Hale High School in Seattle, WA. In addition to radio, Paul's interests include golf and photography.

Almost

Getting a Start with Fox 61 Student News

by Stefanie and Amy Lang

Connecticut's Fox 61 Student News is a nationally recognized program that gives students real-world experiences in broadcast journalism and production, but it gave the Lang sisters much more than that. Their stories have won them cameras and editing equipment for their middle school, scholarship money, and even a little fame.

When we were younger, we used to tell people that we wanted to be famous. We had no idea that our names and faces would become widely known throughout our school, community, and state so soon.

It all started with Captain Nathan Hale School's Challenge and Enrichment Program (CEP), which allowed us to participate in a variety of extracurricular activities. When we were in seventh grade (Stefanie first, and Amy a year later), our CEP teacher, Mr. Thomas Dzieck, suggested that we embark on a new challenge—the Fox 61 Student News program.

For the Student News program, students produce 55-second news stories on various topics to submit to Fox 61 for evaluation. If accepted, the stories are broadcast on Fox 61 as part of a student news segment that runs throughout the day and even during the 10:00 p.m. news hour.

The Perfect Duo

We each easily discovered our roles in the production process. The idea of being on television really sparked Stefanie's interest, so she immediately assumed the role of the anchor, the person in front of the camera. The anchor narrates the story, conducts interviews, and brings the story to life. Stefanie loved being in the spotlight and has been there ever since!

A year later, Amy also tried being the anchor for her first few stories. She felt uncomfortable in front of the camera, so she started doing some camera work instead. The cameraperson must film shots that will grab the viewers' attention. Amy will do whatever she has to do to get a good shot, even if it means hanging out the window of a moving vehicle to film a vintage bomber!

In middle school, we worked separately on stories with crews of three or four people. But as we became more experienced, we learned to produce stories with just the two of us. And with one sister wanting to be in front of the camera and the other behind, we made the perfect duo.

The Heart of the Matter

Producing stories requires a lot of work, but we also have a lot of fun. The most critical part in producing a Student News story is coming up with a topic that will appeal to a wide range of viewers. We've produced stories about flight simulators, K-9 police dogs, The Stock Market Game, and Space Camp. Our stories have allowed us to fly simulated airplanes, steer a train, stand inside a plane engine, and meet students from Russia. We never know where the next story will take us.

Our favorite story that we have collaborated on was about the Pan-Massachusetts Challenge, a cross-state bicycle ride. Participants raise money for The Jimmy Fund, a charity for cancer research and awareness. Most of the people we interviewed, including a family friend, had a story to tell about their own battle with cancer or that of a loved one. Hearing their stories made us feel more connected to the story we were producing, which made it more meaningful.

The Lang sisters at last year's Fox 61 Student News Awards Ceremony.

AMOUS

Amy films as Stefanie interviews Billy Starr, founder of the Pan-Massachusetts Challenge.

The Finishing Touches

Editing is both the best and the worst part of producing a story. Expressing our creativity starts with finding and selecting the most interesting shots. For example, a shot where the camera has been placed on the ground to film bicyclists riding off into the distance would be much more appealing than just an eye-level shot.

But the hardest part of editing is telling a full story in only 55 seconds. We have to stick with the who, what, when, where, why, and how of the story. We had a very difficult time shortening the Pan-Massachusetts Challenge story. We had so many incredible interviews, but there just wasn't enough time. Editing a story can take anywhere from an hour to weeks at a time, depending on how much material we have.

After we edit and finish the story, we send it to Fox 61 where it is evaluated on originality, editing, interviews, delivery, writing, audio, video, and overall presentation. Waiting for the evaluation feels like forever! But finding out that our story will be broadcast always makes the wait worthwhile. There's nothing more rewarding than seeing our hard work on TV.

Between the two of us, we've submitted more than 40 stories to Fox 61, and only three of them haven't been broadcast. We've won awards for nine of our stories, and three of those awards have included scholarship money. It's been a nice start to our college funds.

Taking it Further

Our participation in the Fox 61 Student News program has given us the knowledge and opportunity to film various community activities and events, including the dedication of our school's auditorium, graduation, band concerts, and talent shows. Every month we also film story time at our local library and put together an informative show for CEED, a program for new mothers.

Stefanie is also in charge of CoventryVision Channel 13, a local cable access channel that posts town announcements. Each announcement has its own slide, and for each slide, Stefanie has to gather the information and cut it down to less than 30 words. It's a change of pace from being the anchor, and she's learning how to run a TV channel.

There have been several occasions when strangers have told us that they recognize us from TV; it takes us by surprise every time. Our childhood dreams of being famous are becoming a reality. ■

***Amy Lang*, 15, is a sophomore at Coventry High School. She is in the Albert Schweitzer Club, a community service club, and she mentors a fifth grader. Amy enjoys her Computer-Aided Drawing class, talking on the phone, going online, and having a good time with friends.**

***Stefanie Lang*, 16, is a junior at Coventry High School. She plays the clarinet in her school's band and wind ensemble and is a thrower for the track and field team. Stefanie plans to pursue a career in broadcast journalism.**

Playing Favorites

An Exploration of Bias in the Media

by Aaron Back

Like many people, in the past few months you have probably logged on to news Web sites, read newspapers, and tuned in to news programs more than ever before. You have formed opinions and perhaps taken sides based on what you've seen and read. You probably feel more informed about current events than you ever have.

In the United States, the First Amendment guarantees the independence of the media from the government. But can you be confident that the information you receive daily from the media is accurate, balanced, and unbiased?

For years, a debate has raged in America over the news media's role in shaping public opinion. On the one hand, conservatives and Republicans complain of what they see as a leftward tilt of the national news media, owing in large part to the political opinions held by most journalists. Liberals, on the other hand, have argued that the journalists' opinions are countered by the interests of the large corporations that dominate modern news media, and by other forms of indirect pressure, from advertisers and the like. And complaints have come from all corners that the media's concern with ratings and profits has led to sensationalist coverage.

Political Bias

Bob Dole complained loudly in 1996 that the press corps was aligned against him. Studies have at least partially backed up his claims. Surveys have found that at least 80% of Washington-based news correspondents voted Democrat in every Presidential election since 1964. After the 1992 election, for instance, a Media Studies Center survey of Washington-based reporters found that 89% voted for Democrat Bill Clinton, 7% voted for Republican George H. W. Bush, and only 2% voted for Ross Perot. The popular vote was 44% for Clinton, 37% for Bush, and 19% for Perot.

But do the opinions of journalists necessarily affect their work? Shouldn't reporters seek to deliver objective facts to the public, or at least to present both sides of an issue, leaving aside their own prejudices? Polls show that reporters are modest about their ability to do so. When asked to assess their own work, less than 1% of reporters say that their opinions never affect their coverage, while 78% say that their opinions affect their work at least "occasionally."

In response to this perceived liberal bias in the media, conservatives have started operating their own news services, which often have an open rightward bent. "Try us for a different political perspective" is the slogan of the *Washington Times*, founded in the 1980s by conservatives. Roger Ailes, the Chairman of Fox News Channel, speaking of the channel's owner, Rupert Murdoch, and himself, said in an interview, "The fact is that Rupert and I believe that most of the news tilts to the left." He defines the mission of Fox News as "to provide a little more balance to the news."

Money Matters

Bias among journalists, however, is not the whole story. Progressive and liberal groups argue that their protests against corporations and moneyed interests are drowned out in a media dominated by multibillion-dollar businesses. NBC, for instance, is owned by General Electric, one of the largest corporations in the world. Its main cable news organ, MSNBC, is a joint venture with Microsoft, which dominates the software market for personal computers. CNN is a subsidiary of AOL-Time-Warner, the largest media conglomerate in the world, which puts out America Online, HBO, *Time* and *Life* magazines, *Sports Illustrated*, and a plethora of other sources for entertainment and information.

There is some evidence that conflicts of interest do occur when the reporting of a story conflicts with the bottom line of a corporation. For example, during the stock market crash of 1987, GE's famous CEO Jack Welch told NBC news anchor Larry Grossman not to use phrases like "Black Monday" to describe the trading day when the Dow lost more than 500 points. Welch was worried that pessimistic reporting would further depress the value of GE's stock.

Pressures can also come through advertising. Media companies need revenue from advertisers to turn a profit. When a business is unhappy with a story, it has the option to cease its relationship with the media outlet that ran it. In a survey of television reporters conducted by the group Fairness and Accuracy in Reporting (FAIR), nearly three-quarters reported that advertisers had "tried to influence the content" of news at their stations. More than half reported that advertisers had attempted to kill stories.

Give 'em What They Want

The very nature of American media, composed largely of profit-seeking businesses, creates another problem for objective reporting. During elections this can work for both Democrats and Republicans by marginalizing third-party candidates. If a majority of viewers are predisposed to the two major parties, a media agency risks losing audience members by devoting coverage to the less-popular third-party candidates. This can become a self-reinforcing process, whereby the public only hears about the two major parties and hence is only interested in those two parties.

This process plays itself out on all sorts of issues. Certain stories are known to grab public attention, such as sex scandals. The media tries to play to people's preferences by devoting more coverage space to these issues, while marginalizing others. This is known as the "echo-chamber" effect, whereby stories gradually take on their own momentum and importance.

Competing media outlets also compete to break a story first, which leaves less time for careful fact-checking. This was one explanation as to why networks called states early on the night of the 2000 Presidential election. A network that delayed calling a state in one direction or the other risked having viewers switch to a channel with more up-to-date information.

Detailed studies have not yet been completed on the 2000 election. On that long, suspenseful night, however, when the national media declared Florida a shoo-in for Gore, then moved it back to the undecided column, then declared it for Bush around 2 a.m. EST, and then finally moved it back into the undecided column in the wee hours of the morning, several interesting things occurred. Tom Brokaw, a Democrat, after several hours of being on the air, said at one point that "we" were ahead in Florida, referring to Al Gore's emerging lead; and the first network to call Florida for Bush was Fox News. In the media storm that followed, pundits from both political camps squared off daily. Accusations of bias flew, along with some of the most intense and vitriolic political debate this nation has seen in modern times.

SELECTED RESOURCES

Fairness and Accuracy in Reporting
www.fair.org
Liberal-leaning group that focuses on corporate and advertiser pressures

Media Research Center
www.mediaresearch.org
Accuracy in Media
www.aim.org
Conservative think-tanks that focus on alleged liberal media bias

Institute for Public Accuracy
www.accuracy.org
Watchdog over "corporate-backed think-tanks" such as the Heritage Foundation and the Cato Institute

The Founding Fathers envisioned a system where, free from government intervention, competing news agencies would, in the end, provide the people with an honest, accurate debate on public matters. Clearly the system has generated a degree of honest reporting not seen in, say, Communist China.

But clearly it is not perfect. The lesson is that a viewer must be discriminatory and cautious. Diversifying your news sources is one good way to ensure that you are getting more than one side of a story. But more than that, it is up to the intelligent citizen to take news with a grain of salt, knowing that there is always more going into a story than meets the eye. ■

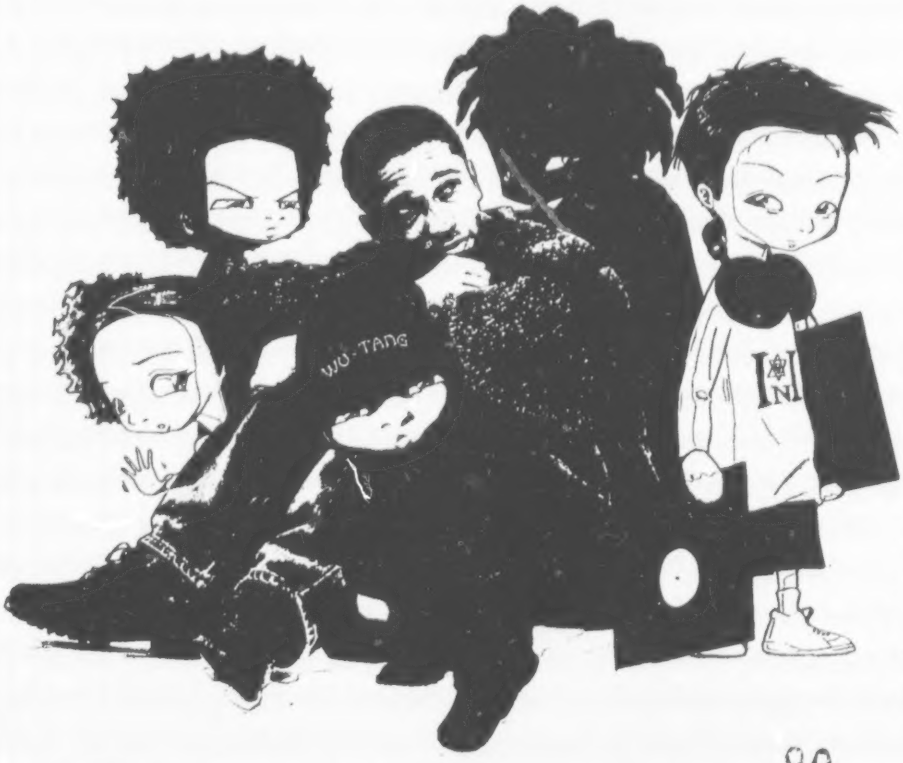
Aaron Back is *Imagine*'s student assistant. A junior at Johns Hopkins University, Aaron is majoring in economics.

HUMOR WITH AN EDGE

Interview with Aaron McGruder, creator of *The Boondocks*

In 1996, Aaron McGruder, then a student at the University of Maryland, started writing a comic strip for the Web. When the student paper, The Diamondback, *picked up the strip in 1997,* The Boondocks *started attracting national attention.*

Now a syndicated comic strip, The Boondocks *tells the story of a group of African-American kids who've moved from big cities to the predominantly white suburbs. Taking on political and racial issues with a sharp satirical edge,* The Boondocks *has stirred up some controversy on the comics page. But as Aaron McGruder says in this interview, the strip is getting people "talking about things openly."*



How did you go about becoming syndicated?

I took the standard route, I guess. I took all the strips that had run in college papers (about 30) and sent them off to the big syndicates. The return results were mixed. Some flat rejection, some promising phone calls, which eventually led to rejection, and some "wait and see." During the summer of 1997, I attended the National Association of Black Journalists' annual convention with the hope of making some newspaper contacts who would support the strip, and I actually met a Universal Press Syndicate executive. I was offered a contract at the end of that summer.

Your strip is quite different from anything in the newspaper today. Do you feel like you are pioneering a new voice for minorities in newspapers today?

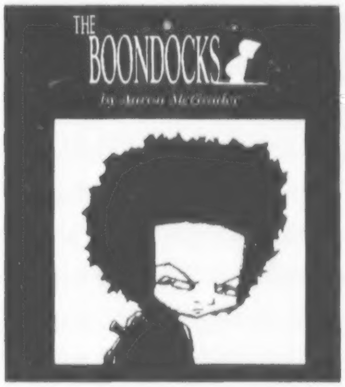
That's how people seem to be taking the strip. I'm coming from a hip-hop foundation, which is about honest, creative expression that isn't watered down or scared. I'm coming from the perspective that if you have something to say, you should do so without fear or hesitation but with great thought and preparation.

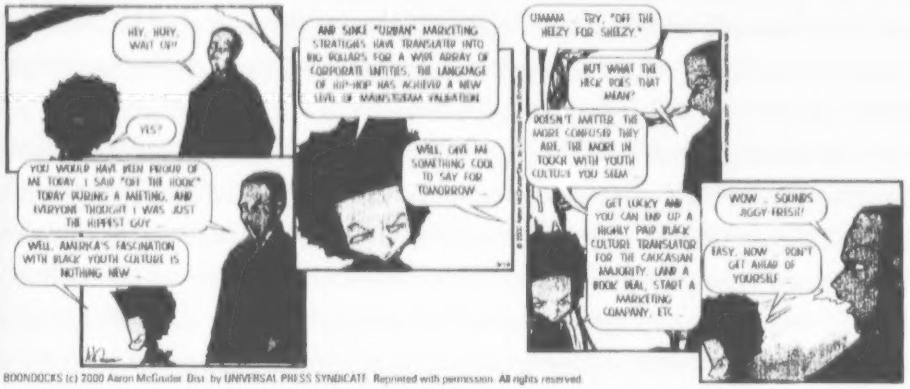
People are amazed that I say the things that I say to mainstream America, but really it shouldn't be that big of a deal. The problem is that information is so controlled and limited in this country that different perspectives are quickly seen as offensive or subversive.

I have a responsibility to the black community to represent us accurately, depicting us both in writing and art in such a way that black people will be proud to allow their children to read. Also, it has been really important to me to try to expose the beauty of black children artistically in a way that exhibits the intelligence and sophistication of young black kids today. Then I build upon that in the writing of the strip. Black people are going to be watching very closely to see if something is misrepresented. And for good reason. They've been horribly misrepresented in the past.

What does the success of the strip represent to you?

I'm very grateful to the newspaper edi-


THE BOONDOCKS
by Aaron McGruder


HEY, HUEY, WAIT UP!
YES?
YOU WOULD HAVE BEEN PROUD OF ME TODAY. I SAID "OFF THE HOOK" TODAY DURING A MEETING, AND EVERYONE THOUGHT I WAS JUST THE HIPPEST GUY ...
WELL, AMERICA'S FASCINATION WITH BLACK YOUTH CULTURE IS NOTHING NEW ...
AND SINCE "URBAN" MARKETING STRATEGIES HAVE TRANSLATED INTO BIG DOLLARS FOR A WIDE ARRAY OF CORPORATE ENTITIES, THE LANGUAGE OF HIP-HOP HAS ACHIEVED A NEW LEVEL OF MAINSTREAM VALIDATION
WELL, GIVE ME SOMETHING COOL TO SAY FOR TOMORROW ...
UMMMM ... TRY, "OFF THE HEEZY FOR SHEEZY."
BUT WHAT THE HECK DOES THAT MEAN?
DOESN'T MATTER. THE MORE CONFUSED THEY ARE, THE MORE IN TOUCH WITH YOUTH CULTURE YOU SEEM ...
GET LUCKY AND YOU CAN END UP A HIGHLY PAID BLACK CULTURE TRANSLATOR FOR THE CAUCASIAN MAJORITY, LAND A BOOK DEAL, START A MARKETING COMPANY, ETC ...
WOW ... SOUNDS JIGGY FRESH!
EASY, NOW ... DON'T GET AHEAD OF YOURSELF ...

BOONDOCKS (c) 2000 Aaron McGruder. Dist. by UNIVERSAL PRESS SYNDICATE. Reprinted with permission. All rights reserved.

tors who signed on to *The Boondocks* early and made the launch so successful. To me, judging not only from the launch but the overwhelming response, I would say it's an indicator that while America has a long way to go before it tackles its racial issues, people from all walks of life are ready to start talking about things openly and addressing these taboo issues with candor and honesty. That's a good first step to solving problems.

How do you get your ideas?

Ideas come from everywhere. Sometimes they seem to manifest out of thin air like magic; sometimes I'll say something or a friend will say something that's just enough of a spark to ignite a strip or a week of strips. I think coming up with ideas is just about being conscious of what's around you, of what you're laughing at and why. I just make sure to keep my eyes and ears open and then see what I can do with what I observe and absorb.

Talk about your love of cartooning. How did you first become interested?

Honestly, I'm not sure if I have a love of cartooning. I love hip-hop, and I love drawing (sometimes). I love telling stories and developing characters. I love arguing and debating and getting a point across. I have a strong interest in the global racial dynamic and how it shapes politics, sociology, culture and so on.

So, to me, cartooning seemed to be one of the few ways to express all of these things simultaneously. Some people cartoon just for the love of the medium. I don't think that's me, yet. I'm still struggling to make the medium work for me. The spaces are too small, the deadlines are too unforgiving and the industry is still too nervous and sanitized for my taste. But I'm working on that.

How do you feel about the reader comments received by newspapers running your strip, both pro and con?

The strip is accumulating a growing number of "rabid" fans, which is good. The strip also seems to have a lot of curious onlookers. That's good, too. To the extent that the pro and con comments lead to debates and discussion of sensitive racial topics—I think it's all wonderful. Some of the people who attack this strip are just not getting the joke and do not understand the nature of satire.

Where do you go from here?

Hopefully, *The Boondocks* will continue to grow and remain funny. I've become interested in other mediums as a vehicle for the strip in addition to print, like animation and possibly some merchandising. But that's a bit into the future. My goal for right now is to become the best cartoonist that I can be. It's a great medium because there is so little standing between me and the readers. Sure the editors at the syndicate and at the newspapers have some say, but Universal Press Syndicate doesn't alter my voice, so there aren't a lot of hands in the strip trying to alter its direction—which is good. It's not like TV or movies, where you have to contend with so many different forces because someone else is paying all the bills.

What advice can you give young, aspiring cartoonists?

1) This is a job that requires so much creative output that you absolutely have to work from your heart, and ignore market forces or what people may tell you is the right way to go to sell a strip.

2) Believe in yourself, and then remember that only so much of this is in your hands. Tenacity, perseverance, and all that stuff are a necessity, but they still won't guarantee you success. More than 99% of the people who aspire to be syndicated cartoonists will not make it. For those who do make it, the struggle takes decades. Be open and flexible with your creativity. Know all the options for your talents. Don't be so focused on one medium that other opportunities go to waste or slip by unnoticed. I was interested in illustration, screenwriting, doing fine art, and comic books while pursuing syndication. I knew if I didn't succeed in one medium, I would in another. That's the mentality to keep. Know that you will succeed, and then keep your mind open as to how it will happen.

3) Master your craft. No amount of flash, quick talking or fine color reproductions from Kinko's can make up for good writing and good artwork.

4) Once you've mastered your craft, you have to sell it. Here's where a tasteful amount of flash, quick talking, and fine color reproductions from Kinko's can come in handy. All of the above helped me when the time came. The best art does you no financial good if it's never seen. Be totally unafraid of rejection, and get your work noticed by people. If it's at all possible, make them like you as a person. Know the difference between being persistent and being a pest.

5) No, the syndicates don't know everything, and yes, they all might be wrong about your strip. ■

Interview courtesy of Universal Press Syndicate.

The Voice of the People

I F

in age

by Chris Pace

In an age of interactive media, the written word might seem antiquated. But according to multimedia developer Chris Pace, technology is actually giving new life to words—and more power to those who work with them.

Most people have become so accustomed to living in this digital era that they take for granted the upheaval and innovation in communication that has occurred over the past decade. The growth of the global network known as the Internet (and its most visible manifestation, the World Wide Web) has altered our view of art and entertainment forever. Every form of artistic expression has been affected and enhanced by the interactive multimedia experiences presented by these new technologies.

For example, the hugely successful ***Blair Witch Project*** can attribute much of its unexpected success to the Web site that the filmmakers created to promote the movie, which helped to build a devoted fan base months before the film was released. Large multinational music corporations, which until now have had exclusive control over the release and distribution of the recordings of their artists, have been turned on their ear by Internet-based services like Napster, which offer users the ability to swap digital versions of songs and forced an ongoing re-examination of conventional copyright laws. And almost everyone is making the switch to digital cameras, which allow users to quickly transfer images to their home computers and distribute them via e-mail or post them to a Web page without spending a lot of time and money on film and processing.

For most of us, writing and speaking are still our primary forms of expressions, and certainly are much more common skills than, say, the ability to shoot and edit video or write and record music. As a result, it's the way that we interact with language, particularly written language, that has been most affected by the new modes of communication offered by the Web.

My Story

There are a million different stories of how people built new careers around the Internet. Some people were attracted by the pioneering spirit that pervaded this new frontier, while others were attracted by the promise of true multimedia, combining music, text, and video with new interactive technologies such as Shockwave and Flash. My own career as a builder of Web sites and multimedia CD-ROMs evolved, oddly enough, out of my love for reading and writing.

After an undergraduate career as an English major at Davidson College and a stint in a graduate English program at University of Virginia, I started working at a law publishing firm in Charlottesville. At the same time, I was exploring the strange new universe of the World Wide Web. I authored my first Web page just a month after going online for the first time, a page devoted to a writer named Paul Auster (on whom I had written my undergraduate thesis), and quickly became entranced by the burgeoning online world and my ability to contribute directly to it.

It wasn't long before I began to use my HTML skills at work, and eventually I found myself in charge of updating my department's section of the corporate Web site and exploring new ways of using the Web to market and sell our books. Excited about the possibilities offered by the Web, I left the publishing world to pursue a Web/multimedia development career.

The Web has changed the way we communicate forever and has lived up to much of the potential that led me to choose it over traditional publishing. Letters that take days to reach their recipients have been replaced by e-mails that can be read seconds after they have been sent; newspapers, traditionally published no more than twice a day, now find themselves lagging behind online news portals that can update their stories on a minute-to-minute basis. Even oral communication, with its immediate, back-and-forth nature, has been replaced online by instant messaging. But perhaps the most important innovation brought about by the Web is the great potential that all of us have been granted to become published authors.

Start the Presses

For most of recorded history, only the upper classes were literate, because they were the only ones who had the leisure time to learn how to read and write and the wealth to afford expensive books. But in the 15th century, Johannes Gutenberg invented the movable type printing press and spawned a revolution that led to the birth of the novel and widespread literacy among all social classes.

Just as the Gutenberg press created a culture in which reading became a common skill, so too will the simplicity of publishing on the Web transform the world of authoring. This change has already begun: the best example is the Weblog (also referred to as a "blog"), an online journal that is often updated daily by its creator. The blogging community is made up of thousands of individuals from nearly every nation who post links, essays, rants, and stories from their lives that are available to anyone with Web access. There are even free services like Blogger that provide free tools and Web space for anyone who wants to start their own Weblog.

"In a world where everyone can be an author with a potential readership of millions, what could be more important than words?"

And it's not just anonymous individuals who have been empowered by the ability to publish themselves on the Web. Some high-profile experiments in e-publishing have already been attempted by established authors (most notably Stephen King, who charged $1 per chapter for a new serial novel that was only available online). But the real promise of this new method of publishing may lie in the not-too-distant future, when no book will ever go out of print because it will always be available for download and when unknown authors can use the Web to sell, distribute, and promote copies of their work without the backing of a large publishing house.

In my professional life, I write mostly in code, building Web sites with HTML, JavaScript, and Cascading Style Sheets, but on my own time I devote almost all of my Web-related energies to the creation of written content. In addition to maintaining the site on Paul Auster, I also keep a daily Weblog, write articles for a music review site that I co-founded in 1996, and edit and contribute to Zyzo, an experimental site that combines articles on contemporary culture with a symbol-based, untraditional navigation scheme. I have chosen not to pursue writing as a professional career, but it is still a vital part of my daily life and my primary form of personal expression, thanks almost entirely to the ease of publishing myself on the Web.

The Future of Writing

The non-linear, decentralized structure of the Web—in which anyone can write, publish, link to, or comment on anything—may seem to be at odds with the traditional author-reader hierarchy established by centuries of printed works. In the end, however, we may find that the open and collaborative nature of the Web may actually help to increase the vitality of the written word, rather than portend its doom. Because in a world where everyone can be an author with a potential readership of millions, what could be more important than words? ■

Chris Pace **earned a B.A. with Honors in English at Davidson College and embarked on a career as an editor at a publishing house before becoming a full-time multimedia developer in 1996. He has worked on award-winning Web sites and CD-ROMs for clients like the Discovery Channel, the Maryland Institute College of Art, BBC America, and the National Geographic Channel, and keeps a daily Weblog with photos, links, and personal writings.**

Lights, Camera, Upload, Connect and...

by Aisling Kelliher

Picture the scene. You're in a large outdoor arena, watching your favorite band perform live. Using the networked video camera on your phone, you capture some shots of the lead singer, the security men throwing water on the crowd, and the enthusiastic fan bouncing up and down beside you. You then use your phone to send a message to your best friend, attaching the shots you have just captured. She's at home, watching a live streaming multicast of the concert, containing all the footage being captured by the people on her "buddies" list.

Later, when you return home, you log on to your video server, access the shots you took at the concert, select some additional footage captured by other people, throw in a segment from the band's latest music video, and upload the final movie to your Web site.

As a member of the Interactive Cinema group at the MIT Media Lab, I am helping to make scenes like these possible.

Let's Make a Movie

How many times have you watched a movie and wished it had ended differently? Or wanted to know more about one of the characters and wished the movie had concentrated more on him or her? Or wondered what else was going on in a scene that the camera wasn't showing?

Two years ago, I joined a group that responds to those types of concerns. The Shareable Media Project is a research initiative within the Interactive Cinema group that seeks to create an interactive Web site where filmmakers, artists, storytellers, and audiences can communicate and ultimately collaborate on the moviemaking process.

The system we envisioned would create an evolving, inclusive, and dynamic story environment containing many different stories told and retold through many different voices. We want users of the system to be able not only to view, evaluate, and rank the movies on the Web site, but also to recut and re-edit any of these sequences—putting together their own optimal ending, for example.

We also want users to be able to upload their own movie clips to add to the sequence, or reuse parts of the original sequence with their own footage to create an entirely different story. For example, I might upload a movie sequence telling the story of the day my little brother was lost at the fair, until we finally found him eating cotton candy behind the ghost train ride. Another user might then upload video footage of aliens flying through the sky and re-edit the sequence to make it look like my brother was abducted temporarily by little green men. Or another user could put together a scary horror sequence, detailing what my brother saw when he accidentally went on the ghost train. Each of these interpretations could be stored on the Web site, and all visitors to the site could see how the story evolves over time as more and more users tell the story as they would like it told.

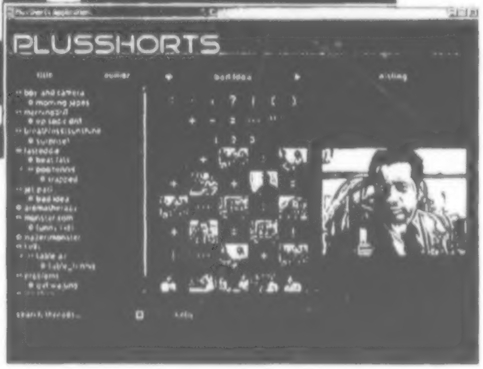
Cool Tools

Our team has developed a variety of novel visual interfaces and editing tools to allow users to manipulate and arrange clips into sequences. For my part, I was most interested in allowing filmmakers to share thoughts about the structure of the movie sequences they were creating on the site. Thinking of a video sequence as just one instance within a larger, evolving "movie thread," I wanted to create the equivalent of a newsgroup discussion—only using movie clips instead of text. That's how the PlusShorts application was born.

Within PlusShorts, participants can begin a movie thread by posting a sequence of movie clips they have either found on or uploaded to the Shareable Media database. Other users of the system can then respond to that post by rearranging, deleting, or adding to the sequence, thus creating their own interpretation of the story.

To further enhance understanding and stimulate discussion between users, the PlusShorts application uses punctuation as a markup language for describing the structure of movie sequences. Users can place punctuation symbols between clips to show what they were thinking when they put the sequence together. For example, placing a colon after a movie

Action!



clip might mean that it was an introductory clip, or placing parentheses around a number of clips could indicate a dream sequence or flashback.

As part of the software development process, the system was tested and evaluated at a workshop for visual artists and filmmakers, held at the MediaLabEurope in Dublin, Ireland. There, I gained tremendous feedback about the usefulness of the system as a storyboarding tool, about the problems encountered with synching audio, and about possible future developments for the application. I completed the PlusShorts application as part of my master's degree.

Getting Here, Going... Where?

My path to MIT has had many twists and turns along the way but has always been underpinned by a deep love for movies and the storytelling power of the moving image. I made my first forays into the moviemaking world as an undergraduate in communication studies. As the digital era came into play, my explorations led me to undertake an M.Sc. in multimedia systems at Trinity College in Dublin, Ireland. I was fascinated by the new potential to weld computational power with sound, graphics, text, and movies. I was intrigued by the possibility of combining all this with sensing technology, interactive techniques, and distributed networks. And I knew that there was already an audience of people hungry for new experiences. It was at this stage that I first met Professor Davenport, director of the Interactive Cinema group, who encouraged me to apply to the Media Lab.

Coming to MIT's Media Lab has afforded me an opportunity to develop my work in even more daring directions with a team of creative researchers, all working in an environment where inventive craziness is encouraged and the absurd applauded. I am now developing my research in new directions towards a Ph.D. I am particularly interested in developing software for creating a "video blog." A blog (abbreviated from "Weblog") is an online, regularly updated journal or diary where the blog owner can post thoughts, opinions, favorite links, photos, or stories. An estimated 400,000 bloggers are publishing content on the Web today. I want to develop an easy-to-use tool that will allow these publishers to integrate video content with their daily musings.

As a wee girl in Dublin, I always dreamed about someday having my little stories played out on the big screen. The screen might have gotten smaller, or turned into a watch, or even be projected onto the side of a moving bus, but the desire to entertain, provoke, affect, and delight people remains the same. ■

For more information about the Interactive Cinema group, visit http://ic.www.media.mit.edu/groups/ic/

The Media of the Future
MIT Media Lab

If you think e-mail and the Internet have revolutionized communication, you should see what's shaping up at the MIT Media Lab. From wearable computers to machines that sense their users' frustrations and adapt accordingly, the media of the future is starting now. For links to these projects and others, visit the MIT Media Lab site at www.media.mit.edu

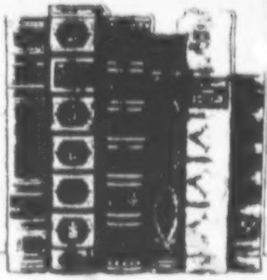
Opera of the Future
Imagine a musical instrument that understands how you want to perform the piece—even if you don't play it exactly that way. This group develops such instruments for musicians of all levels and, among other projects, develops musical toys for children.

Synthetic Characters
The best virtual characters are much more than cartoons, and this group is finding ways to make the best interactive characters for use in virtual environments. Sounds fun—but it's all based on research on such issues as the emotions behind choosing actions, learning and adaptation, and physical motion.

Lifelong Kindergarten
With a network of Computer Clubhouses, this highly interdisciplinary group gives inner-city youth a chance to try out their new computational tools and toys, including programmable LEGO bricks.

Human Design
What is human? What is machine? It's not always easy to identify which is which, and the line becomes blurrier with advances in technology. This group seeks to address the problems presented by the "human-machine symbiosis" with the goal of preserving human values, expressiveness, and happiness.

Aisling Kelliher earned a B.A. in communication studies from Dublin City University, an M.Sc. in multimedia systems from Trinity College, Dublin, and an M.S. in media arts and sciences from MIT. Aisling loves reading, going to the movies, collecting windup toys, DJing badly, and playing the odd hand of poker. You can read more about Aisling's work at www.media.mit.edu/~aisling

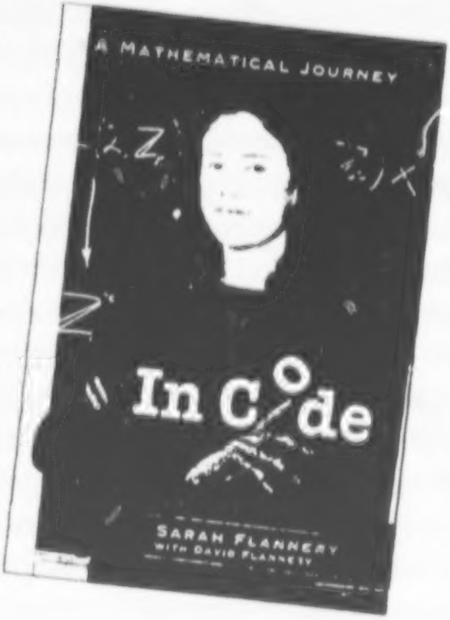


Off The Shelf

In Code: A Mathematical Journey

Review by Kelle Love

Teenagers are rarely expected to make important contributions to the scientific or technological world. So when 16-year-old Sarah Flannery developed a cryptography encryption algorithm that rivaled RSA (an established, standard system for encoding data), she ended up on the front page of the London *Times*. The media blitz that followed changed her life, and now she has written a book about the experience. *In Code* is an account of her life as both a celebrated young scientist and an everyday Irish teenager.



Flannery, whose father is a mathematics professor, grew up in County Cork surrounded by math and computers. From a young age, she and her siblings worked problems on a chalkboard in the kitchen as dinner was prepared.

In high school, when she needed a project for a science competition, she naturally turned to her father. He suggested that she try programming some cryptography algorithms. Her original project consisted of making comprehensible to the public some previously existing algorithms—including RSA, the first public-key cryptosystem, which was developed at MIT in 1977 by Ronald Rivest, Adi Shamir, and Leonard Adleman and has withstood all manner of attacks since then. The project was well done: At the Esat Young Scientist & Technology Exhibition, it won the Individual Intermediate Mathematics, Physics and Chemistry category that year (1998) and received the Intel Excellence Award (which made Flannery Ireland's representative at the Intel International Science and Engineering Fair). However, it was not innovative enough to win Ireland's Young Scientist of the Year competition.

To fulfill a school requirement designed to give students a taste of real-world work experience, Flannery arranged to spend a week at a cryptography company in Dublin. There she was given an unpublished paper written by the founder of the company, Michael Purser, and was asked to try to write code to implement his ideas. At her father's suggestion, she used matrices (an invention of the 19th-century mathematician Arthur Cayley) as a new setting for Purser's ideas and came up with what she called the Cayley-Purser, or CP, algorithm. This won her Young Scientist of the Year awards in both Ireland and Europe in 1999.

In Code is intended to be accessible to readers lacking a strong mathematical background. Flannery and her father (who, in order to speed the manuscript along, helped write the book's mathematical chapters) try to explain for a broad audience the mathematics behind encryption. This is commendable, and innovative. Unfortunately, the attempt meets with only partial success. They begin with straightforward mathematical definitions and work up to the basics of number theory, hoping to dispel readers' fears of math. However, this level of mathematics is too difficult to be simply read and understood, and despite their claim that "you shouldn't have to open another book to understand this one," readers would be better served by working through a textbook on number theory. Although the chapters on mathematics are placed in the middle of the book and interrupt the narrative, I would urge that readers at least skim them.

Being familiar with cryptography myself, I was interested in learning more about the CP algorithm and the theory behind it. Unfortunately, Flannery barely touches on her own discoveries, which are potentially the most interesting part of the book; instead, she devotes pages to explaining the standard RSA algorithm. This omission is both frustrating and mystifying.

In spite of these shortcomings, *In Code* is both inspiring and compelling. I especially enjoyed the mathematical puzzles that Flannery worked as a child. She does a good job of describing the difficulties of learning theoretical mathematics and programming algorithms, and she creates a rich picture of the tense environment surrounding science competitions. Flannery's passion for mathematics is apparent; however, in much of *In Code*, her rough prose is evidence of the difficulty in writing memoirs at the age of 18. ■

This article originally appeared in *American Scientist*, Vol. 89, pages 468-69. Reprinted by permission of *American Scientist*, magazine of Sigma Xi, The Scientific Research Society.

Kelle Love graduated from the North Carolina School of Science and Mathematics last June. She now attends Reed College in Oregon, where she plans to major in mathematics. Kelle enjoys creative writing and Web design.

Word Wise:
GREAT COMMUNICATORS

by Carol Blackburn

Note: For clues that are quotations, the answer is the person who wrote or said it.

ACROSS

1 "The lion and the calf shall lie down together but the calf won't get much sleep."

6 "Unsafe at any speed."

11 "The victor will never be asked if he told the truth."

12 "'C' students run the world."

13 "All great truths begin as blasphemies."

15 "We will have peace with the Arabs when they love their children more than they hate us."

16 Where's the __?

17 Dream sleep

19 Journey

21 Light sensitive relay (abbr.)

22 "These are the __ that try men's souls." —Thomas Paine

24 Compass point

25 Salt lake state

26 "Walk softly and carry a big stick."

27 Major news syndicate

29 Vanderbilt U locale

30 "We are all worms. But I do believe I am a glow-worm."

31 Scoffing sound

33 "__ tu, Brute?"—Julius Caesar

34 Nein

35 Again (prefix)

36 Nightmarish street

38 "The __ has reasons the reason knows not of." — Pascal

41 "Mad, __, and dangerous to know." — Lady Caroline Lamb

42 Close loudly

44 Record company

45 "__ thy father and refuse thy name..." — Juliet

46 Sports association (abbr.)

48 Shakespeare

49 "What a waste it is to lose one's mind. Or not to have a mind. How true that is."

51 Scopes trial lawyer

52 "Always do right. This will gratify some people and astonish the rest."

53 "I have a __..." — M. L. King, Jr.

DOWN

1 Smartest

2 Alternative

3 Swedish king

4 Kind of drop

5 Year (abbr.)

6 Windows edition

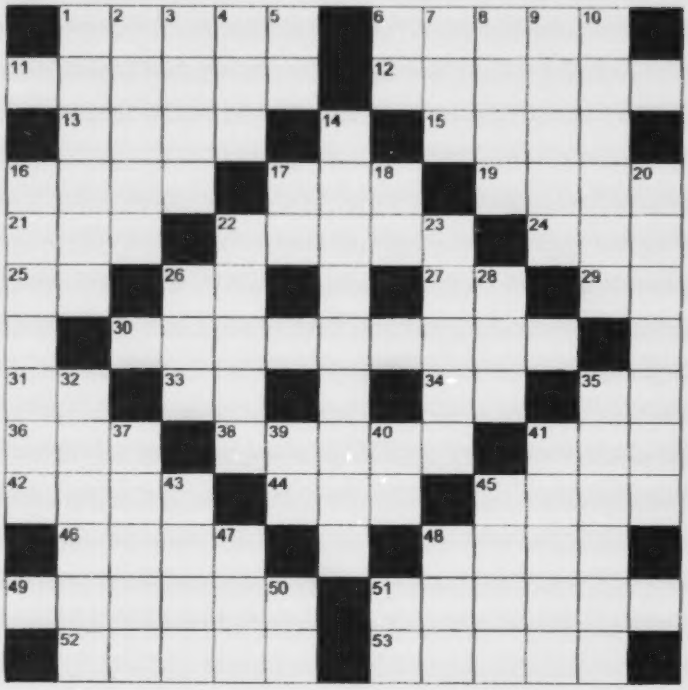
7 Fortify

8 Performing couple

9 Arab rulers

10 Most uncommon

14 What Woodrow Wilson wanted to make the world safe for



16 "Man is the only animal that __. Or needs to." — 52 Across

17 Brown U home

18 Kennebunkport locale

20 "If a free society cannot help the many who are poor, it cannot save the few who are rich."

22 "When you have eliminated the impossible, whatever remains, however improbable, must be the __." — Sherlock Holmes

23 John, Paul or George

26 Article

28 Arafat's organization

32 Bogart in *The African Queen*

35 Haphazard

37 Colorful parrot

39 TV show

40 Sun god

41 "Baseball is 90% mental; the other half is physical."

43 Yucatan native

45 Risk

47 "Float like a butterfly, sting like a bee."

48 Lawyers' exam

50 __ garde!

51 Doctor of divinity (abbr.)

Solution on page 34

Molecular Modeling

Interview with David Goodsell

by Carol Blackburn

To create pictures of biological molecules, scientists draw upon chemistry, biophysics, molecular biology, and computer graphics. In a world where science blends into art, biologist-artist David Goodsell is right at home. An associate professor at the Scripps Research Institute, he creates software to visualize and model the behavior of biological molecules. And when computer graphics aren't enough, he paints.

What is molecular modeling?

Molecules are incredibly tiny, and we have no way to look at them directly. We're so used to seeing images of molecules that some people may not realize that we cannot actually see individual molecules, even with the most powerful electron microscope. They're just too small.

This is where I come in. We need to create pictures of molecules, based on experimental data, so we can study them. Scientists always need tools for exploring and analyzing, and for showing others what they've seen or done. This is particularly true of biological molecules, which are incredibly complex. In my work, I do both molecular *graphics*, creating pictures based on experimental data, and molecular *modeling*, using computers to predict how 3-dimensional molecular structures interact and how changes in structure will affect a molecule's behavior or function.

How did your interests in science and art begin?

I've always been interested in both art and science. My grandfather was an artist, and he started me painting when I was five. I still use the same watercolor palette that we bought together. All through school, I did all kinds of painting—landscapes, portraits, lots with a science fiction theme. But the painting was always just for fun. I always knew I was going to be a scientist. I was a big science nerd as a kid—bug collections, chemistry sets, microscopes and telescopes. You name it and I had it.

How did you choose to study molecular structure?

I'm a very visual person. One day when I was in college, I saw a grad school recruiting poster. It had a big picture of a molecule and "Learn crystallography" written under it. And I knew that this was it. Discovering the 3-dimensional structure of molecules—it fit me perfectly.

I went to UCLA and studied X-ray crystallography, which involves taking X-ray images of crystals. In biology, we use it to study large molecules, like proteins and DNA, that can be purified and crystallized. The process does not produce a photograph of an individual molecule but rather a unique pattern as X-rays pass through the crystal. Then, knowing the protein's amino acid sequence—its linear structure—we try to figure out what 3-dimensional arrangement of that amino acid chain would produce the X-ray image we got.

Were you studying a particular molecule?

Yes, I was studying the binding of a drug to DNA. By comparing the X-ray images of crystals with and without the drug, we could figure out where the drug was binding. The drug turned out to fit perfectly into a groove in the DNA helix. It was really fun to use computer graphics to come up with ways of visually slicing through the molecules to show that perfect hand-in-glove fit. With the computer graphics programs we have now, that's easy to do. But back then, the technology was still brand new and it was a real challenge.

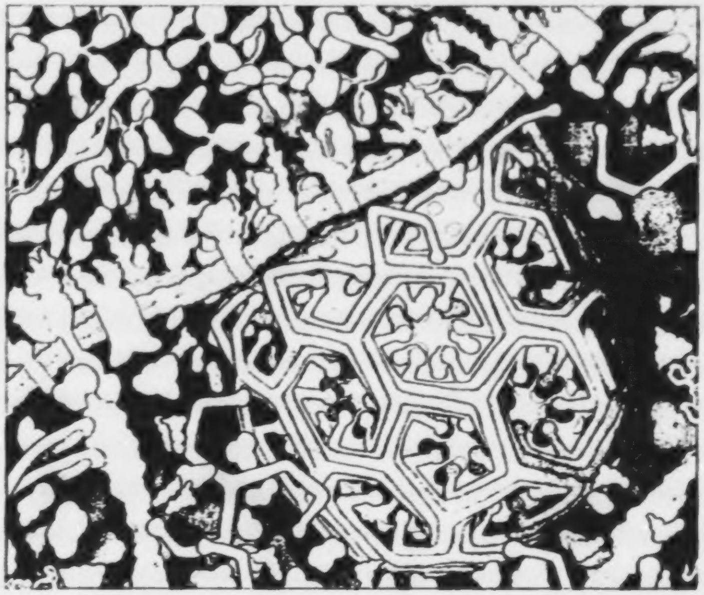
What did you do next?

I realized that I was a better theoretician than a "bench" scientist, so I decided to focus on the part of the work I loved, visualizing molecules and creating software to do so. I came here to Scripps as a post-doc. I spent half of my time on computer graphics, developing the software I now use to do molecular illustrations, and the other half of my time developing software to model the way small molecules bind to proteins. This type of software is at the heart of the exciting field of computer-aided drug design.

Tell us about that.

I'll tell you about a project we're working on now. HIV has an enzyme called a protease that is essential for the maturation of the virus. If you block it, you kill the virus. The protease has a big, cylindrical active site that binds the substrate (the enzyme's normal target molecule). The goal is to come up with a different small molecule that exactly fills that site, filling all the bumps and valleys, and blocks the normal action of the enzyme.

In the old days—a decade or two ago—if a pharmaceutical company wanted to find a drug to inhibit an enzyme, it would command its army of chemists to synthesize hundreds of molecules similar to the natural substrate. Then it would have an army of biologists test those hundreds of molecules in biological assays, to see which ones fit the best. They might cycle through this process several times, to get the best fit they could find. The process would take years.



Watercolor illustration of a B-cell membrane, with blood above and the cell interior below. Blood-borne molecules are bound by cell-surface receptors, then pulled into the cell by three-armed clathrin triskelions. The clathrin molecules bind together, creating a geodesic enclosure for the internalized molecules.

Today, we can make a computer model of an enzyme's active site, then calculate how well various small molecules bind to it. We can simulate thousands of enzyme-drug interactions in the computer. When we finally find a molecule that fits and matches up just right, then we can ask a chemist to synthesize the molecule and test how well it works.

That sounds much more efficient than the old way!

We've actually been taking this approach even one step farther. One of the problems with HIV is that it mutates very quickly, which enables it to develop resistance to drugs. Instead of having one enzyme that you're trying to block, you really have thousands of permutations: the wild type and a whole series of mutants that could develop. If you need one drug to block the wild type and another to block mutant A and yet another to block mutant B, it's endless.

What we've done is to examine millions of potential mutants and challenge them with a bunch of potential inhibitors. It's like a big war: the inhibitors are trying to kill all the viruses, and the viruses are trying to evolve to evade all the inhibitors. What you get at the end of the simulation—the surviving inhibitor—is a molecule that blocks many different variants. It may not be the best inhibitor of any one enzyme, but it has a much wider range of effectiveness than an inhibitor that is a perfect fit for one particular enzyme. If we can come up with one or two or three molecules that can block the whole range of protease structures, the virus shouldn't be able to develop resistance.

As you can imagine, this kind of simulation is absolutely enormous. To make it feasible, we had to use a fairly simple model of the enzyme-drug interaction. We wanted that initial simulation to show us which potential inhibitors were the most important to look at in detail. We're now doing more careful simulations with the more promising inhibitors. And anyone who wants to be a part of this effort can. We launched a project last year called www.FightAIDSatHome.org, in which thousands of people around the world run our modeling software on their

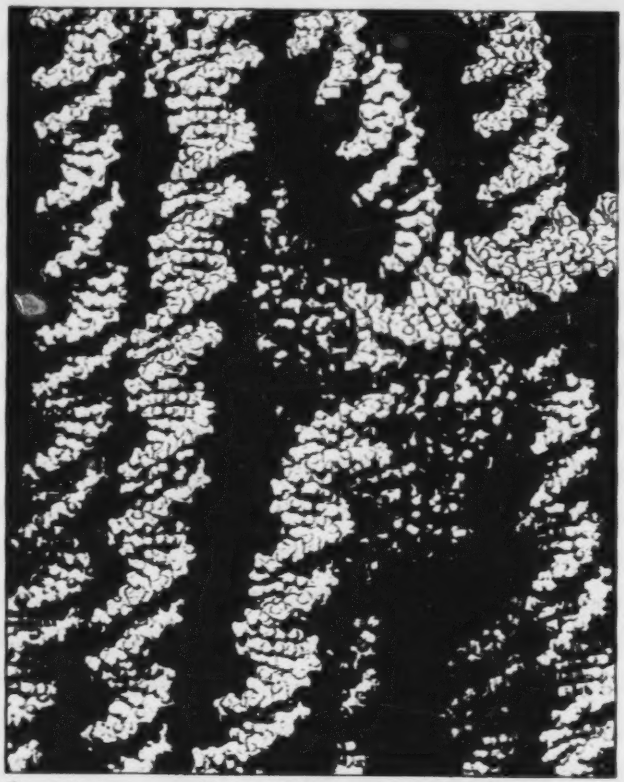
PCs when they're not in use. Eventually, we'll test the most successful inhibitors in biological assays.

Tell us about the artistic side of your work.

I started very practically, using computer graphics to create pictures of the structures I was studying when I was a grad student. DNA is so beautiful, how could you not want to draw it?

I began doing paintings of molecules and cells when I was a post-doc. As scientists, we get incredibly specialized, and I felt I was losing touch with the magic of science. I realized that, as much as I love the highly specialized work I do, I also need to synthesize information, to show how the little jigsaw piece I am working on fits into the whole picture. My paintings are a way for me to put my highly specific work back into a larger biological context—to put the life back into my science.

I've continued to do that in a variety of ways. I've written and illustrated two books for the general public (and a new one on bionanotechnology is on the way), and I write a column called "The Molecular Perspective." I love to give people an idea of what a molecule looks like, how its shape relates to its function, and how people experience that molecule in their own life. I also work with the Protein Data Bank (PDB), a huge repository of structures that have been analyzed by X-ray crystallography. Every month, I illustrate one molecule and write a short introduction to it—a sort of molecular cameo. I'm trying to provide a friendly gateway into the PDB, to entice people to come in and explore.



Computer-generated image of two molecules binding to DNA. On the left, a small drug fits snugly into the minor groove of DNA. On the right, a transcription initiation complex takes a more aggressive approach, grabbing the DNA and bending it as it binds.

What's the future of molecular modeling?

It's exciting. In the work I do with the docking of small molecules to protein targets, our ability to make accurate predictions is very good. In other areas of molecular modeling, we're not yet quite as good at making predictions. For example, it's difficult to predict how two large proteins will interact; there are many more variables, so the process of modeling interactions is much more complex. We're even less confident when we try to take a gene sequence and predict structure from that.

But lots of very clever scientists are working on these larger problems, with all expectations of solving them in the not too distant future. We're looking forward to an age when prediction is a really strong tool on many levels.

And for scientists with artistic inclinations?

Many scientists are very open to and interested in the arts. Illustration has been an important part of science since its beginning. In molecular biology, there are many excellent computer graphics packages for drawing pictures of molecules, and most scientists now make their own images. I think many of them enjoy that artistic outlet. But they still have to come to someone like me for images that are outside the range of options offered by those programs, so there will be a continuing need for molecular illustrators.

I'm also seeing more and more use of scientific imagery in fine arts. Many people are interested in art that reveals the world that science opens up for us, a vision of the world that is available only through science.

Do you have any final words of advice?

Just that careers aren't as hard and fast as you might think. I always had this picture of a scientist as someone who does research and writes grants and papers and gets the Nobel Prize. I've come to appreciate that the spectrum of ways to interact with science is much broader than that and can include someone like me, who mixes science education and basic research. There are many exciting and rewarding ways to contribute to the great collage of scientific understanding. ■

For more about molecular modeling and molecular art, see www.scripps.edu/pub/goodsell and www.cty.edu/imagine/links_93.htm

Planning Ahead for College

The Impact of High School Choice on College Preparation and Admission

by Linda E. Brody, Ed.D.

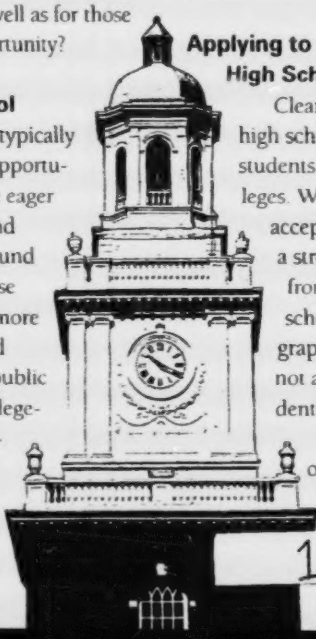
When it's time to apply to college, how much will it matter where you went to high school?

If you attend a highly selective high school—whether a magnet school, a private school, or a public school with a strong reputation—you may be disadvantaged in the college admissions process. This was the conclusion of a recent study, widely reported in the press, by sociologist Paul Attewell. He found that students from selective high schools had lower grades and class ranks and often took fewer advanced courses than students with comparable test scores at less selective schools. He also observed that students admitted to top universities had higher test scores if they came from a selective high school than if they came from a local public school, suggesting they had to meet higher standards to be admitted.

Yet demand for magnet and other selective high schools is so great that many well-qualified students are turned away. Why are students eager to enroll in these schools? What are the implications for college admission for students who attend selective high schools, as well as for those who do not have this opportunity?

Choosing a High School

Selective high schools typically offer wonderful learning opportunities for students who are eager for academic challenges and are energized by being around other bright students. These schools are likely to offer more opportunities for advanced students than the typical public school does, including college-level courses and opportunities for internships and independent research. These schools provide a peer group of other motivated students who comprehend more advanced content and learn at a faster pace. The rigorous curriculum also helps develop strong study skills, preparing students well for college.



Some students, however, will not excel in such a competitive environment. Even highly able students may find the workload and stress overwhelming. Being surrounded by so much talent can undermine some students' self-confidence and contribute to poor performance. Often, students who are not among the high achievers may find themselves assigned to lower level classes, negating one of the reasons they chose to go to the school in the first place.

If you are thinking about enrolling in a highly selective high school, consider your options. Will the selective school meet your academic and social needs? Do you think you can excel there? Alternatively, can you get the courses you need at your neighborhood school and find a peer group? Which environment will motivate you to achieve your full potential?

Applying to College from a Selective High School

Clearly one issue with selective high schools is that so many of their students want to attend the same colleges. While a given college usually accepts more applicants from a strong magnet school than from any single neighborhood school, they do want geographic diversity, so they may not accept all of the magnet students who are qualified.

It is also difficult to stand out when you are surrounded by so many bright students. If you haven't taken the most advanced courses and earned top grades, received excellent teacher recommendations, and excelled in extracurricular activities—difficult things to accomplish in a school with an exceptional student body—it will be hard to compete with students who have done these things.

However, colleges also respect the academic rigor of selective schools and the students who attend them. If you have worked hard and done reasonably well, and don't have your heart set specifically on Princeton, for example, you will have many excellent college choices. And, if you do excel in the competitive high school, there will be no limits to where you can go and what you will be prepared to do there.

Applying from Your Neighborhood School

If you are applying from a lesser known school, you will have to stand out more to be admitted to a highly selective university because you won't have the school's reputation behind you. But it may be easier to stand out if you are highly motivated.

If you take the most advanced courses your school offers, your counselor will be able to say "yes" in response to the question on your college application, "Did this student take the most rigorous courses available?" If the course offerings are weak compared to the magnet schools, you can take additional courses at a local college, in a summer program, or via distance learning. Your school may have fewer extracurricular activities than selective schools, but it may be easier to gain a leadership role, or you can become involved in activities outside of school. In general, you may have to work harder to make opportunities for yourself, but, if you do so, you can get a great education and be attractive to colleges as well.

So choose the high school that will best meet your academic and social needs. When it's time to apply to college, show how you've taken maximum advantage of whatever opportunities you've had, and demonstrate how these opportunities have helped you grow as a person. If you do this, you will be well prepared for college, and plenty of terrific colleges will be eager to have you as a student. ■

PRINCETON UNIVERSITY

The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 36 students, who major(ed) in aerospace engineering (2), art history (1), chemistry (1), comparative literature (1), computer science (1), East Asian studies (2), economics (4), electrical engineering (5), English (2), financial engineering (1), history (1), math (8), molecular biology (3), physics (5), and politics (2). (The number of majors exceeds 36 because some students had double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Reviewers used superlatives in praising the faculty for their excellence, accessibility, and dedication to undergraduate education.

➤ "The quality of instruction at Princeton is exceptional. The university stakes its name and reputation on undergraduate instruction, and it does not disappoint. Unlike most universities, Princeton's priority is its undergraduates, not its graduate students."

➤ "The top-notch faculty includes Nobel and Pulitzer Prize winners. Many are the authors of their courses' textbooks. You can tell they love their material and want you to love it, too. You can't resist an atmosphere like that!"

➤ "Despite the inevitable occasional disappointment, Princeton lives up to its reputation for outstanding undergraduate education, challenging even the brightest students. Classes are almost universally very intellectually stimulating. Lectures are fast-paced, insightful, and often entertaining, while weekly preceptorials (discussion sections) allow one to go over material in a more casual small group setting. I also got to know two professors quite well while working under their tutelage on my two Junior Papers."

➤ "The professors could not be more accessible. They reach out to students with an openness that is far beyond the call of duty. I've had professors talk with me for hours about what major to choose, or what grad school programs to apply to. The professors at Princeton have been my philosophers, guides, and friends."

➤ "Most teachers are very good, but I found the math faculty to be notably lacking in communication skills."

➤ "Class sizes vary from 5 to 500. In many classes, it's difficult to earn a grade below B or B-. However, that's not to say that Princeton is easy. On the contrary, the academic atmosphere is tough because the students are all very bright and the professors expect a lot. Most humanities classes, for example, average at least 200 pages of reading per week and perhaps a short paper."

Social Life

For the first two years, students live and eat in one of five residential colleges. In the last two years, many students join "eating clubs," which are the heart of Princeton's social life. Prospective members "bicker" for admission to five of the eating clubs (a process like fraternity rush) and sign up for the other six clubs on a first-come basis.

➤ "For over 100 years, a unique system of eating clubs has been central to Princeton's social life. Most juniors and seniors join one of the eating clubs, which are like fraternities but nicer. Most partying occurs at the eating clubs. Those who don't party get together with friends or go to NYC or Philadelphia (both accessible by train, with a station right on campus). Lots of other clubs and activities round out the social life and make it impossible to be bored."

➤ "Located in a township that lacks a full-fledged movie theater, the town of Princeton is small and very quiet, so the entire life of the university is confined to the campus and the eating clubs. There is really no nightlife in town. That said, there is always plenty to do, from the many remarkable guest speakers (Stephen King, Hillary Rodham Clinton, and Patrick Stewart, to name a few who came while I was there) to the Tony-award-winning theater."

➤ "If you want big city culture or 'real-world' exposure, Princeton is not the place to be. The closest big city is an hour away, which is not a trivial distance on a busy schedule."

➤ "The moments were not few in which my roommate and I found ourselves stupidly confounded by the question, 'What do you want to do tonight?' The stores and cafes on campus or on Nassau Street all close around midnight, which is bothersome when that's when you finally finish enough work to deserve a study break. A small college town does limit your options. But despite such moments of despair, I was content. Someone is always there with a sympathetic ear, or thinking up something crazy to do."

➤ "Princeton is a blast! The environment is conducive to both social and intellectual growth. At Princeton, a student can experiment with every facet of life in a safe, healthy environment. I had the best time there."

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➤ "Social life is horrendous! People primarily go out only on Thursday and Saturday nights from midnight to 3:30 a.m.!"

➤ "The stereotype is that Princeton students' calendars are so booked that they have to make appointments to see their friends. Sadly, this is very true. Everyone here is insanely busy doing something and doing it well."

What Do You Like Best about Princeton?

Reviewers valued the education, the people, and an intellectual and social environment that fosters the best in many students.

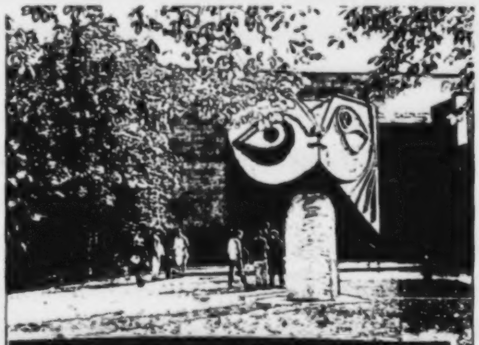
➤ "Princeton is a very challenging environment academically and socially—you rise to your own potential."

➤ "I loved the camaraderie of my fellow students, who provided a high-caliber social and athletic setting without sacrificing the quality of the academic (or informal intellectual) environment."

➤ "The feeling that I am an integral part of Princeton's fervent intellectual life. To be able to look at the beautiful campus and say, 'I belong here.'"

➤ "I love the sense of community. I have made so many wonderful friends here. I also love the flexibility available to students. With two Junior Papers and a senior thesis, individual interests may be explored and clarified. And the faculty is very supportive of the students' research. I just love Princeton, and I know I will always look back on it with pride."

➤ "Princeton gave me the opportunity to develop in non-academic ways, like leadership and social skills. I gained much that I might not have developed at another school."



Princeton University

Princeton, NJ 08544
(609) 258-3060

- ▽ 4-year private coed college.
- ▽ Campus in a small town.
- ▽ Semester system.
- ▽ Full-time undergraduate enrollment 2001-02: 2,380 men; 2,231 women.
- ▽ Special features: a "Gothic kingdom of a campus" (as one college guide book describes it), Woodrow Wilson School of Public and International Affairs, Institute for Integrative Genomics, and the nation's oldest debating society.

What Do You Like Least about Princeton?

Some reviewers found the workload oppressive, while others commented on the lack of diversity.

➤ "The workload was crazy; it was like a four-year marathon. It wore me out. Also, in keeping with tradition, fall semester finals are *after* winter break, so you have constant, year-round stress."

➤ "I am always too busy to take advantage of all the great speakers and activities on campus. The workload, as far as I'm concerned, is often unbearable. Several times I just didn't know how I would make it through a semester."

➤ "Princetonians tend to be quite conservative and homogeneous. Even those who come from atypical (for Princeton) backgrounds seem homogenized. Because traditions are an essential part of the Princeton experience, conformity seems to be prized. Lack of diversity and anti-progressivism are Princeton's weakest points."

➤ "My only criticism concerns the engineering program, which is not as in-depth as one at an engineering school. What I learned, I learned well; but what I learned was mostly the basics. As a result, I felt extremely prepared for grad school, but I would not have been prepared for a job. Tech firms know this and do not recruit at Princeton. The companies that do actively recruit Princeton engineers are the consulting firms."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Princeton?

➤ "Someone who is self-motivated and is going to get what they want. To get the most out of Princeton, you have to be willing to go talk to professors, do good independent work, and take advantage of the opportunities available."

➤ "Someone who enjoys a small but by no means limiting community."

➤ "Princeton students tend to be mature, confident, ambitious individuals who play—and often excel at—sports, play an instrument on the side, and can handle with poise a difficult academic load. I would not recommend Princeton to someone who wants to focus on only one particular pursuit. As for the stereotype, it's true that an enormous chunk of the student body are children of Princeton alums, varsity athlete recruits, or individuals from wealthy backgrounds."

If You Had It to Do over Again, Would You Go to Princeton?

All but six reviewers said yes, most with great enthusiasm. Three were unsure, and three said no.

➤ "Yes, yes, a thousand times yes!"

➤ "Yes. Though there are aspects of the school that I wish I could change, I don't think I would have received a better education anywhere."

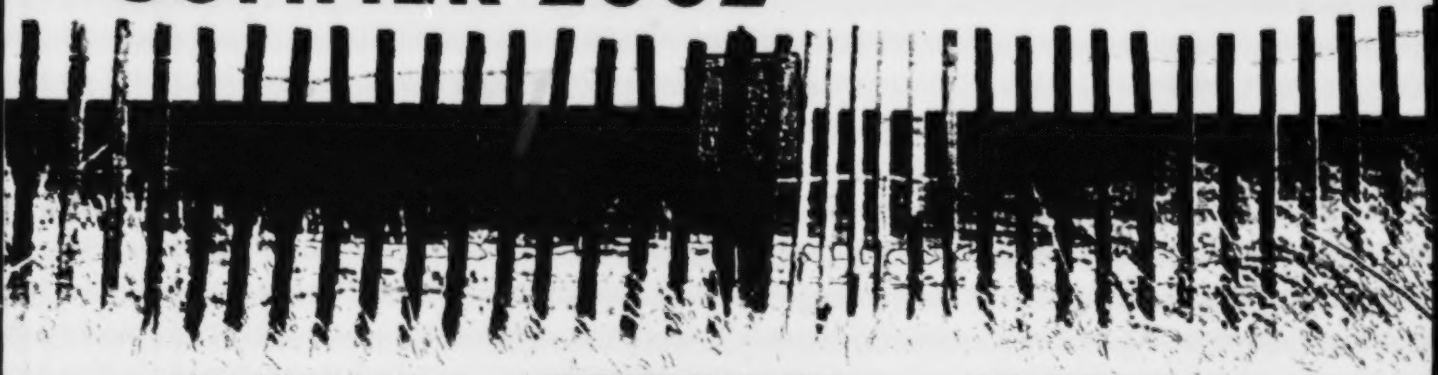
➤ "I'm not sure. The education was second to none, and I was pushed in ways that made me stronger, but did that make all the pressure worthwhile? I don't know if I would have learned as much had I not been so challenged. So it's hard to say."

➤ "In choosing Princeton, I failed to consider the location and quality of life, overlooking these factors for academic reputation. While I don't regret my experiences at Princeton—the education is truly incomparable—I would likely choose a different college were I to do it again."

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

SELECTED ACADEMIC PROGRAMS

SUMMER 2002



Academic challenge doesn't have to end with the school year. Summer can be a time to explore new topics or to concentrate intensively on a subject that you enjoy. No matter where your academic interests lie, there is a summer program for you. The programs listed below are among the best available for academically talented students.

Space in many summer programs is limited, so we suggest you apply early. You'll want to inquire about qualification requirements, course options, dates, fees, and scholarship availability.

JOHNS HOPKINS UNIVERSITY CENTER FOR TALENTED YOUTH SUMMER PROGRAMS

CAA 7th Grade & Above

Grades 7 and up, three weeks, residential sites in CA, MD, PA, and RI.

CTY 7th Grade & Above

Grades 7 and up, three weeks, residential sites in CA, MD, NY, and PA.

CTY Young Students

Grades 2–6, three weeks, day sites in MD, CA, and VA. Grades 5 & 6, three weeks, residential sites in CA, MA, MD, and PA.
CTY Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277; www.jhu.edu/gifted/ctysummer

OTHER REGIONAL TALENT SEARCH PROGRAMS

Duke University Talent Identification Program

Grades 7–10, three weeks, residential. *Duke University TIP, Box 90747, Durham, NC 27708; (919) 684-3847; info@tip.duke.edu; www.tip.duke.edu*

Northwestern University Center for Talent Development

Grades 4–12, three weeks, residential and commuter. *CTD, Northwestern University, School of Education and Social Policy, 617 Dartmouth Place, Evanston, IL 60208-4175; (847) 491-3782; ctd@nwu.edu; www.ctd.northwestern.edu*

University of Denver Rocky Mountain Summer Institute

Ages 11–15, two weeks, commuter. Ages 12–16, three weeks, residential and commuter. *Rocky Mountain Talent Search, University of Denver, Wesley Hall, Room 203, 2135 East Wesley Avenue, Denver, CO 80208; (303) 871-2983; ldudley@du.edu; www.du.edu/education/ces/si.html*

RELATED PROGRAMS

Like programs offered by the talent searches, the following programs require qualifying exam scores and offer a variety of science, math, and humanities courses.

California State University—Sacramento Academic Talent Search

Grades 6–9, one to five weeks, commuter. *ATS, California State University–Sacramento, 6000 J Street, Sacramento, CA 95819-6098; (916) 278-7032; ats@csus.edu; http://edweb.csus.edu/projects/ats*

Carnegie Mellon University C-MITES

Grades 3–7, one- and two-week courses, commuter. *C-MITES, Carnegie Mellon University, 4902 Forbes Avenue #6261, Pittsburgh, PA 15213-3890; cmites@cmu.edu; http://outreach.mac.cc.cmu.edu/C-MITES*

Iowa State University Office of Precollegiate Programs for Talented and Gifted

Grades 8 & 9, Explorations!, one week. Grades 8–10, CY–TAG, three weeks. Residential. *OPPTAG, 310 Pearson Hall, Iowa State University, Ames, IA 50010-2200; (800) 262-3810 x1772; opptag@iastate.edu; www.public.iastate.edu/~opptag_info*

Purdue University Gifted Education Resource Institute

Grades 3–6, one week, residential. Grades 7–12, two weeks, residential. *Summer Residential Programs, Purdue University, 1446 LAEB, West Lafayette,* *IN 47907-1446; (765) 494-7243; geri@purdue.edu; www.geri.soe.purdue.edu*

Southern Methodist University Gifted Students Institute

Grades 7–9, TAG program, three weeks, residential. Grades 10 & 11, The College Experience, five weeks, residential and commuter. *The Gifted Students Institute, SMU, P.O. Box 750383, Dallas, TX 75275-0383; (214) 768-4275; www.smu.edu/~gsi/*

Summer Institute for the Gifted

Grades 4–11, three weeks, residential. *Summer Institute for the Gifted, 120 Littleton Road, Suite 201, Parsippany, NJ 07054-1803; (866) 303-4744; info@cgpsig.com; www.cgp-sig.com*

University of Iowa Belin-Blank Center

Grades 6–8, Junior Scholars Academy, one week, residential; grades 7 & 8, Summer Institute for the Arts and Sciences, two weeks, residential; grades 9-11, National Scholars Academy, one week, residential; and grades 9–11, Summer Institute for Creative Engineering and Inventiveness, two weeks, residential. *Belin-Blank Center, The University of Iowa, 210 Lindquist Center, Iowa City, IA 52242-1529; (800) 336-6463; www.uiowa.edu/~belinctr*

University of Southern Mississippi Center for Gifted Studies

Grades 4–8, one week, residential; grades 7–10, three weeks, residential. *The Frances A. Karnes Center for Gifted Studies, The University of Southern Mississippi, Box 8207, Hattiesburg, MS 39406-8207; (601) 266-5236; Gifted.Studies@usm.edu; www-dept.usm.edu/~gifted/*

University of Washington Summer Stretch

Grades 7–9, five weeks, commuter. *Robinson Center for Young Scholars, University of Washington, Box 351630, Seattle, WA 98195-1630; (206) 543-4160; cscy@u.washington.edu; http://depts.washington.edu/cscy/*

Vanderbilt University Program for Talented Youth

Grades 8–11, three weeks, residential. *Laura Montgomery, Program Coordinator, Vanderbilt PTY, Vanderbilt University, GPC 506, Nashville, TN 37203; (615) 322-8261; pty.peabody@vanderbilt.edu; http://peabody.vanderbilt.edu/pty*

Western Kentucky University Center for Gifted Studies

Grades 6–8, two weeks, commuter and residential; grades 7–10, three weeks, residential. *The Center for Gifted Studies, Western Kentucky University, One Big Red Way, Bowling Green, KY 42101-3576; (270) 745-6323; gifted@wku.edu; www.wku.edu/gifted*

Wisconsin Center for Academically Talented Youth

Grades 4–6, one week, residential. Grades 6 & 7, two weeks, residential. Grades 8–11, three weeks, residential. *WCATY, 2909 Landmark Place, Madison, WI 53713; (608) 271-1617; info@wcaty.org; www.wcaty.org*

HUMANITIES

Bates College Summer Forensics Institutes

Grades 9–12, one to three weeks, residential. *Laura Biscoe, Director of Special Projects and Summer Programs, 163 Wood Street, Lewiston, ME 04240; (207) 786-6077; summer@bates.edu; www.bates.edu/summer*

Concordia Language Villages

Ages 7–18, one to four weeks, residential. *Concordia Language Villages, 901 Eighth Street South, Moorhead, MN 56562; (800) 222-4750; clv@cord.edu; www.cord.edu/dept/clv*

Northwestern University National High School Institute

Grades 9–12, four to five weeks, residential. Program options in debate, journalism, media arts, music, theater arts, leadership, and Junior Statesmen. *NHSI, 617 Noyes Street, Evanston, IL 60208; (800) 662-NHSI; nhsi@northwestern.edu; www.northwestern.edu/nhsi*

Spartan Debate Institute

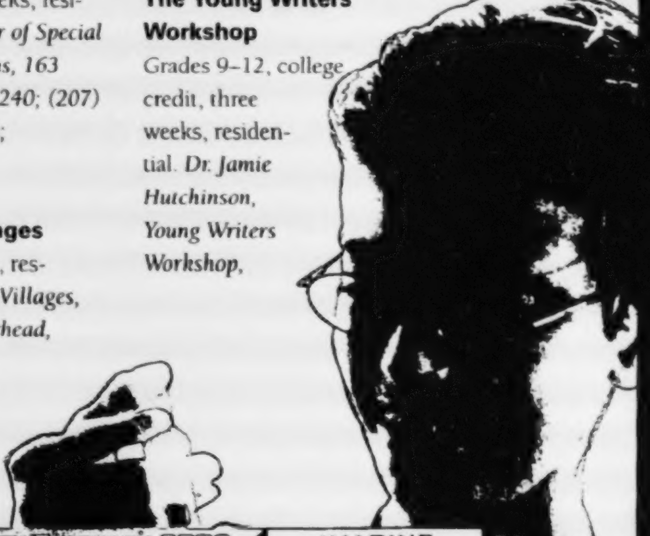
Grades 9–12, two to three weeks, residential. *Spartan Debate Institute, 10 Linton Hall, Michigan State University, East Lansing, MI 48824; (517) 432-9667; debate@msu.edu; www.msu.edu/~debate*

Stanford National Forensic Institute

Grades 9–12, two to three weeks, residential and commuter. *Stanford Debate Society/SNFI, 555 Bryant Street #599, Palo Alto, CA 94301; (650) 723-9086; snfi@mail.com; www.snfi.org*

The Young Writers Workshop

Grades 9–12, college credit, three weeks, residential. *Dr. Jamie Hutchinson, Young Writers Workshop,*



SUMMER 2002

Simon's Rock College of Bard, 84 Alford Road, Gt. Barrington, MA 01230-2499; (413) 528-7231; jamieh@simonsrock.edu; www.simonsrock.edu/academics/summer/summer.html

MATHEMATICS

Canada/USA Mathcamp

Ages 13–18, five weeks, residential and commuter. Rolling admissions. Location varies, year 2002: Colorado College in Colorado Springs. *Mathcamp, 3560 Pine Grove Avenue, Port Huron, MI 48060; (519) 672-7990; info@mathcamp.org; www.mathcamp.org*

Hampshire College Summer Studies in Mathematics

Grades 9–11, six weeks, residential. Rolling admissions. *Summer Studies in Mathematics, Natural Science Department, Hampshire College, Amherst, MA 01002-5001; (413) 559-5375; dkelly@hampshire.edu; www.hampshire.edu/offices/specprog/hcssim.shtml*

Program in Mathematics for Young Scientists

Grades 9–11, six weeks, residential. *PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215; (617) 353-2563; promys@math.bu.edu; http://math.bu.edu/people/promys*

Ross Young Scholars Program

Ages 13–18, eight weeks, residential. *Ross Mathematics Program, Dept. of Mathematics, Ohio State University, 231 W. 18th Avenue, Columbus, OH 43210; (614) 292-1569; ross@math.ohio-state.edu; www.math.ohio-state.edu/ross/*

Stanford University Mathematics Camp

Grades 11 & 12, four weeks, residential. *SUMaC, Department of Mathematics, Stanford University, Stanford, CA 94305-2125; sommer@math.stanford.edu; http://cartan.stanford.edu/sumac/*

SELECTED PROGRAMS FOR JUNIORS AND SENIORS

Students graduating from the talent search programs can take advantage of a wide variety of programs aimed at older high school students.

Below is a brief list of some of these programs. If you don't see the college that interests you represented in this list, contact that school directly. Students applying to these programs should be juniors or seniors in Spring 2002 unless otherwise noted.

Brown University Precollege Program

Seven weeks, residential. *Office of Summer Studies, Box T, 133 Waterman Street, Providence, RI 02912; (401) 863-7900; Summer@Brown.Edu; www.brown.edu/Administration/Summer_Studies/mm/*

Carnegie Mellon Precollege Program

Six weeks, residential. Open to sophomores and juniors only. *Carnegie Mellon Precollege, 5000 Forbes Avenue, Pittsburgh, PA 15213; (412) 268-2082; precollege@andrew.cmu.edu; www.cmu.edu/enrollment/precollege/*

Cornell University Summer College

Two three-week sessions and one six-week session, residential. *Cornell University Summer College Programs, B20 Day Hall, Ithaca, NY 14853-2801; (607) 255-6203; summer_college@cornell.edu; www.sce.cornell.edu/SC/*

Duke University Precollege Program

Six weeks, residential. Open to juniors only. *TIP PreCollege Programs, 1121 West Main Street, Suite 100, Durham, NC 27701; (919) 683-1725; info@tip.duke.edu; www.tip.duke.edu*

Georgetown University Summer College

Five weeks, residential. Open to juniors only. *Special Programs, School for Summer and Continuing Education, Poulton Hall, 2nd Floor, 1437 37th Street, NW, Georgetown University, Box 571010, Washington, DC 20057-1010; (202) 687-5719; harringe@georgetown.edu; www.georgetown.edu/ssce/spp/hsj.htm*

Harvard Summer School

Eight weeks, residential. *Harvard Summer School, 51 Brattle Street, Cambridge, MA 02138-3722; (617) 495-3192; http://ssp.dce.harvard.edu/*

Johns Hopkins University Precollege Program

Five weeks, residential and commuter. Sophomores may also apply. *Johns Hopkins University, Office of Summer Programs, 102 Macaulay Hall, 3400 N. Charles Street, Baltimore, MD 21218;*

(800) 548-0548; *summer@jhu.edu*; *www.jhu.edu/~sumprog/pc*

Northwestern University College Preparation Program

Three to eight weeks, residential. Open to juniors only. *NU College Preparation Program, 2115 North Campus Drive, Suite 162, Evanston, IL 60208-2650; (847) 467-6703; cpp@northwestern.edu; www.northwestern.edu/collegeprep*

Stanford University Summer College

Eight weeks, residential and commuter. *Stanford University, Summer Session, Building 590, Ground Floor, 514 Lasuen Mall, Stanford, CA 94305-3005; (650) 723-3109; summersession@stanford.edu; http://summersession.stanford.edu/college/*

Yale University Precollege Summer Program

Five weeks, residential. *Yale Summer Programs, P.O. Box 208355, New Haven, CT 06520-8355; (203) 432-2430; summer.programs@yale.edu; www.yale.edu/summer*

GOVERNOR'S SCHOOLS

Governor's Schools are highly selective programs for academically or artistically talented high school students. These schools, which run for two to six weeks during the summer, vary widely in their course offerings and admissions criteria. For example, some schools require students to be nominated by teachers or administrators, and many of the arts programs require auditions.

Visit the Web site of the National Conference of Governor's Schools at ***http://ncogs.org/membership/directory/programs.htm*** to learn more about Governor's Schools. If you don't find a link to a school in your state, call either your governor's office or state education agency to find out if your state offers this program.

SELECTED RESOURCES

Educational Opportunity Guide: A Directory of Programs for the Gifted **(Duke University TIP, 2001).**

To order, contact Duke University TIP, Box 90747, Durham, NC 27708; (919) 684-3847; www.tip.duke.edu

Check your library or local bookstore for these titles:

Summer Fun: Travel and International Programs 2002 (Peterson's Guides, 2001).

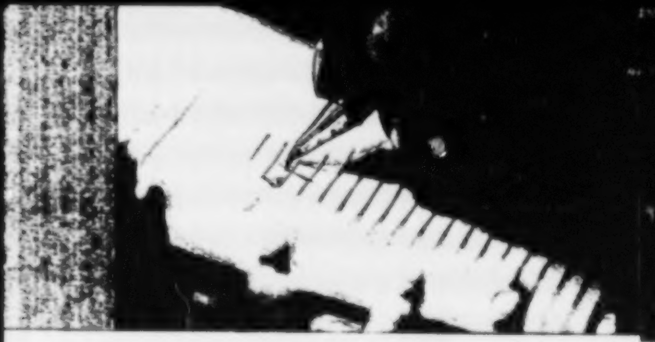
Summer Opportunities for Kids & Teenagers 2002 (Peterson's Guides, 2001).

Yale Daily News Guide to Summer Programs 2002 by Sara Schwebel (Kaplan, 2001).

For these and additional links, see the Imagine Links page: www.jhu.edu/gifted/imagine/links.htm

Last January, we devoted an entire issue of *Imagine* to summer activities. There are listings of some of the most exciting opportunities available, from international research programs and math camps to language immersion programs and writing workshops. And stories from students who have participated in some of these programs as well as valuable internships, volunteerships, and summer jobs.

If you missed out on this great issue, order one today by calling (410) 516-0309.



Mark your Calendar...

with these January-May registration deadlines for selected academic competitions. Inquire about competition format, dates, and fees.

JANUARY 31

Bayer/NSF Award—Teams of students in grades 6–8 and an appointed coach tackle a community issue. *Bayer/NSF Award, 105 Terry Drive, Suite 120, Newtown, PA 18940-3425; (800) 291-6020; www.nsf.gov/od/lpa/events/bayernsf/*

EARLY FEBRUARY

U.S. National Chemistry Olympiad—Teachers nominate students who have taken high school chemistry; call for local test dates. The national exam is in late April. *American Chemical Society, Education Division, 1155 16th Street NW, Washington, DC 20036; (800) 227-5558; help@acs.org; www.acs.org*

EARLY FEBRUARY–EARLY MARCH

National Science Bowl—Teams of high school students compete first in regional contests (see Web site for your state's contest date); winners advance to the national contest held May 3–6. *Sue Ellen Walbridge, Office of Science, U.S. Department of Energy, 1000 Independence Avenue SW, Washington, DC 20585; (202) 586-7231; sue-ellen.walbridge@science.doe.gov; www.scied.science.doe.gov/nsb/*

FEBRUARY 4

Toshiba/NSTA ExploraVision Awards Program—Students register in teams: grades K–3, 4–6, 7–9, 10–12. *Toshiba/NSTA ExploraVision Awards, 1840 Wilson Boulevard, Arlington, VA 22201-3000; (800) EXPLOR-9; exploravision@nsta.org; www.toshiba.com/tai/exploravision/*

FEBRUARY 16

Harvard–MIT Mathematics Tournament—Schools register teams of eight students to participate in team and oral events. Individual students and teams of fewer than eight may request to be matched with other students to form a team. *Harvard-MIT Math Tournament, P.O. Box 425855, Cambridge, MA 02142; hmmt-request@mit.edu; http://web.mit.edu/hmmt/*

MARCH

Harvard Biological Sciences Olympiad—Sponsoring teachers register students in grades 9–12. Students first take a 90-minute school-wide selection examination; two students from each school will be selected to take the national exam. *Ravi Shah, HBSO director, 431 Winthrop Mail Center, Cambridge, MA 02138; (602) 692-5157; rshah@fas.harvard.edu*

MARCH 1

Davidson Fellows Award—Students under the age of 18 apply for scholarships of $50,000 or $10,000 for their work in one of five categories. Preliminary form due March 1; final application due March 29. *Davidson Institute for Talent Development, 9665 Gateway Drive, Suite B, Reno, NV 89511; (775) 852-DITD; davidsonfellows@ditd.org; www.ditd.org*

MARCH 2–20

National French Contest—French teachers register students in elementary through high school to take this exam offered at five levels. *American Association of Teachers of French, Le Grand Concours, P.O. Box 32030, Sarasota, FL 34239; nfc@soltec.net; http://aatf.utsa.edu/concours*

APRIL 1

Destination ImagiNation—Teams of students from kindergarten through college register to participate in this creative problem-solving contest. *Destination ImagiNation, P.O. Box 547, Glassboro, NJ 08028-0547; (856) 881-1603; headquarters@destinationimagination.org; www.destinationimagination.org*

APRIL 2

Physics Bowl—Schools register to administer this 45-minute exam to students in grades 9–12. *AAPT, One Physics Ellipse, College Park, MD 20740; (301) 209-3344; aapt-prog@aapt.org; www.aapt.org/programs/physbowl.html*

APRIL 3

Knowledge Master Open—Junior, middle, and high schools register teams to participate in a computerized test covering 14 curriculum areas that will take place on April 17. *Academic Hallmarks, P.O. Box 998, Durango, CO 81302; (800) 321-9218; kmo@greatauk.com; www.greatauk.com*

APRIL 12

United Nations National High School Essay Contest—Students in grades 9–12 submit a 1,500-word essay on the year's topic. *United Nations Association of the USA, 801 Second Avenue, New York, NY 10017; (212) 907-1323; vwayner@unausa.org; www.unausa.org/programs/nhsessay.htm*

APRIL 25

American Regions Math League (ARML)—Teams of students in grades 7–12 register for national competitions held May 31–June 1 at Penn State, the University of Iowa, and San Jose State University. *Mark Saul, ARML President, 711 Amsterdam Avenue, New York, NY 10025; (212) 666-5188; msaul@compuserve.com; www.arml.com*

MAY 17

National Academic Championship—High school teams register to compete. Local winners advance to the national contest, which is held June 13–16. Reduced fee for registering by May 1. *Questions Unlimited, P.O. Box 14798, Columbus, OH 43214; (800) 868-1518; qunlimited@iwaynet.net; www.qunlimited.com*

MAY 31

ThinkQuest Internet Challenge–Teams of students, ages 12–19, create content-rich Internet sites for submission. *www.thinkquest.org*

More About ... Churchill

Sir Winston Churchill—journalist, historian, statesman, and Prime Minister—is the only political leader ever to win the Nobel Prize for Literature. At the award ceremony, a Royal Academy spokesman said, "His words, accompanied by corresponding deeds, have inspired hope and confidence in millions from all parts of the world during times of darkness. With a slight alteration we might use his own words: Never in the field of human conflict was so much owed by so many to one man."

■	W	O	O	D	Y	■	N	A	D	E	R	■
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Creative Minds Imagine

The Writer and the Muse

by Laurel Jessup

The writer lives two doors down
He is tall with dark, dramatic features
When I pass him in the hall
The smell of the ink that stains his fingers
The smell of tea leaves and coffee
The smell of a damp wool sweater after returning
From a contemplative walk in the rain
Fill my nose
He is quiet
Speaks in soft tones
But looks directly into my eyes
Touching my soul
Occasionally
I find paragraphs or poetry
Scrawled out in his slanted penmanship
In my mail box
But the man living two doors down
Lives in his own world of prose and descriptive dreams
He expresses himself through words
He is a mystery
Someone I would only invite to a private dinner party
He is the writer
Who lives two doors down

The muse lives two doors down
She is voluptuous with soft, dark hair and harsh, storm blue eyes
When I pass her in the hall
The smell of the earthy dyes from the clothes she wears
The smell of her organic lavender perfume
The smell of spices from the oriental dishes she makes
Fill my nose
She is open about her life
She speaks her mind with beautiful articulation
She makes me see the world in a different perspective
Occasionally
She knocks at my door
Asking if I have seen her tabby or if she can borrow some coffee, an egg, or a book
But the woman who lives two doors down
Does not know that she is my muse
She is blind to the fact that
I would be willing to share my world of prose and descriptive dreams with her
She reads what I write and I can see that it touches her deeply
She is exotic
A creature that I dare not take from the wild
Or invite over for coffee
She is the muse
Who lives two doors down.

Laurel won first prize in the 2001 Harlan O. Roberson Poetry Contest for this poem. Sponsored by the Wisconsin Center for Academically Talented Youth (WCATY), this contest is open to Wisconsin students in grades 9–12. For more information about WCATY or this contest, or to read more award-winning entries, visit www.wcaty.org.

Laurel Jessup graduated in December from Gibraltor High School in Wisconsin. An avid participant in outdoor activities, Laurel will embark on a 70-day Outward Bound course this spring.

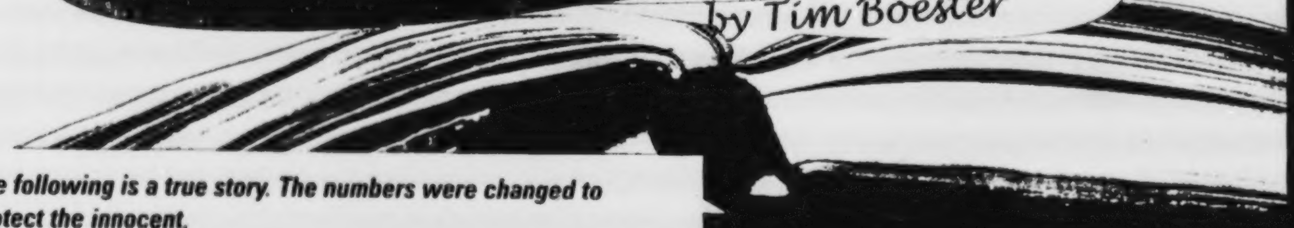
Show Your Creative Side

Creativity is what this page is all about. So send us your poems, your photographs, your stories. Send a creative essay, or slides of your paintings and sculptures.

We're always considering creative work for upcoming issues. Send yours to Melissa Hartman at mhartman@jhu.edu or CTY/Imagine, 3400 N. Charles Street, Baltimore, MD 21218.

Knossos Games

by Tim Boester



The following is a true story. The numbers were changed to protect the innocent.

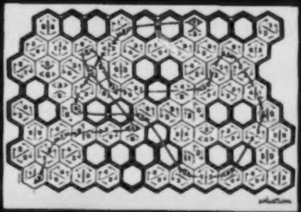
I recently bought some books for my family on a holiday shopping trip. While standing in the checkout line, an overzealous gift wrapper covered my books in gold paper and ribbon before the cashier had rung up my purchase. Faced with the choice of undoing the gift wrapper's handiwork, the cashier and I decided instead to try to determine the prices of the books I was purchasing.

I had slipped my gift list (with the titles and authors) inside one of the books, so that information was unavailable. I did remember that the total cost of the books was $127. However, each one of the books I had purchased was on sale, depending on its subject, and I had remembered the non-discounted total. I purchased one of each of the following: cookbooks were 15% off, mysteries were 20% off, poetry was 25% off, biographies were 40% off, and architecture was 50% off. I also remembered that all of the prices were whole numbers, before and after their discounts had been applied. With the following two clues, could the cashier and I determine how much the books would cost after the discounts had been applied?

One book was $46 before its discount, another book was $20 before its discount.

One book was $1 more than another book before the discounts were applied, but after the discounts, the books were the same price.

Solution to Knossos Games in our November/ December issue:

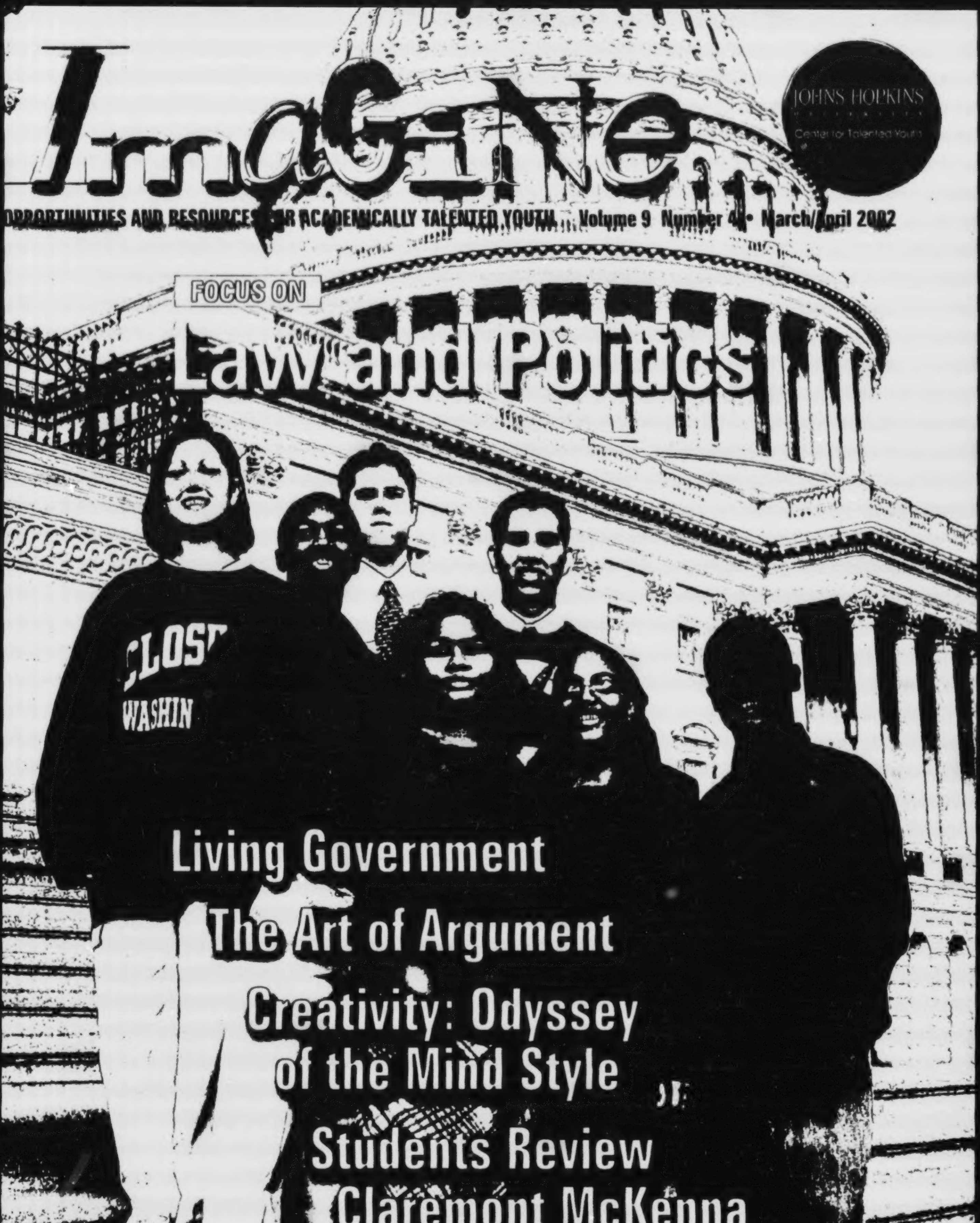


A graduate student in educational psychology a
the University of Wisconsin
Tim Boester now has additio
puzzles on his home page:
http://homepage.mac.com/
boester

Imagine

JOHNS HOPKINS UNIVERSITY
Center for Talented Youth

OPPORTUNITIES AND RESOURCES FOR ACADEMICALLY TALENTED YOUTH • Volume 9 Number 4 • March/April 2002



FOCUS ON

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Living Government

The Art of Argument

Creativity: Odyssey of the Mind Style

Students Review Claremont McKenna

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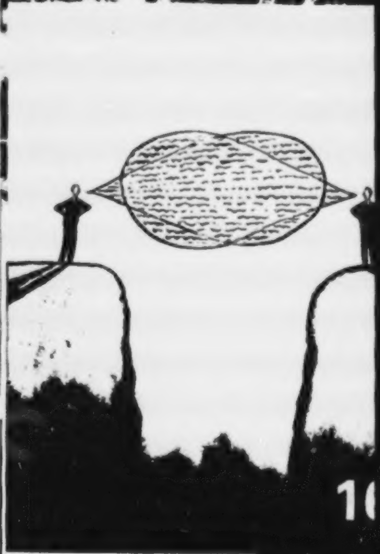

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mAGiNe...

Opportunities and Resources for Academically Talented Youth*

SSN 1071-605X Volume 9 • Number 4
March/April 2002

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JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

Published five times a year—September/October, November/December, January/February, March/April, and May/June.

Periodicals Postage paid at Baltimore, MD, and additional mailing offices.

POSTMASTER: Send address changes to *Imagine*,
P.O. Box 3073, Langhome, PA 19047.

Imagine is published by the Study of Exceptional Talent (SET) at The Johns Hopkins University Center for Talented Youth.

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Annual subscription: $25.00
nstitutions: $30.00

Address subscription inquiries to:
Imagine
P.O. Box 3073, Langhorne, PA 19047
(215) 826-0707 • fax: (215) 788-6887
or order online at www.jhu.edu/gifted/imagine

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Cover photo: © Close Up Foundation, www.closeup.org

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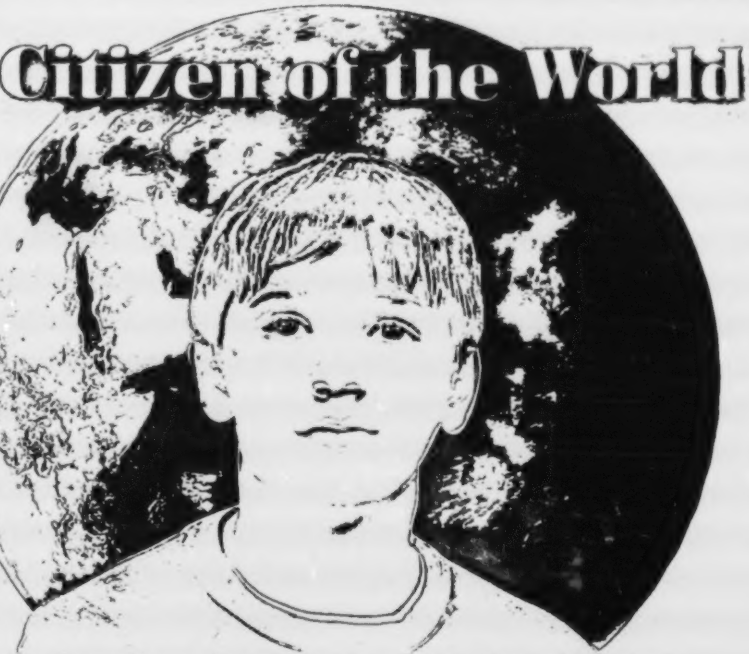
A Citizen of the World



Every day, the world around us grows more crowded and complex, and you need only pick up a newspaper for evidence. When you begin to ask questions about the causes of events that make headlines—whether it's the bankruptcy of a huge corporation or the assassination of a foreign leader—you quickly find that these events have deep and tangled roots. If you could step far into the future, you might see that these events, which didn't seem to affect you personally, have more impact on your own life than you would have guessed. That bankruptcy could affect how you someday invest your retirement dollars. That assassination could limit where you're likely to conduct business.

Even now, a large part of your daily life is structured by events that took place a long time ago and by decisions made by other people in response to those events. Someone decided what you should learn in school. Someone decided that you should be required to have an education at all. Even what you do on your own time is affected by decisions made by people you will probably never meet. Where can you skateboard legally? What movies can you see? When can you drive?

These examples might make it seem that we are at the mercy of social and political forces in the world around us. But in reality, we have a lot of power to affect the world; we can create change not only for our own benefit, but for the benefit of others. We can become active participants in shaping the structures and rules that govern our lives.

In this issue of *Imagine*, we focus on law and politics, two interrelated fields with opportunities for all of us—voting age or not—to become active and informed citizens of our community, country, and the world. This issue's student writers have explored American government, international relations, and the workings of courtrooms. They have helped pass laws and held leadership positions in their schools and communities. They have become involved in causes making a difference for people continents away. They have become critical thinkers and effective communicators, and they have already started to shape our world—all before turning 18.

It's up to you to decide what kind of citizen you will be. We hope that this issue—with its powerful student-written articles and valuable listings of resources to help you get involved—will inspire you to take an active part in the discussions and decisions that affect you, and all of us.

Yes! You can change the world

by David Lau

In October of my sixth-grade year, the talk of the upcoming election for the governor of Illinois reached a fever pitch: we critiqued the number of wrinkles on the challenger's face, the way the incumbent talked, the clothes that he wore. Noticeably absent from our heated discussions was any talk of the issues; we were ignorant about the importance of this election in influencing such central issues as the death penalty and welfare reform. Instead, we debated among ourselves who looked older and who had the more annoying laugh.

However, just one year later, sitting at my new middle school, I found myself with a phone in my hand, calling up all my state politicians and demanding that they pass a school lunch bill.

Birth of an Activist

Seventh grade served as the demarcation point for me between ignorance and knowledge. Growing up in a relatively affluent bubble, I never really noticed the injustices perpetuated by the modern American political system. In elementary school, my educational training on the workings of the American government consisted primarily of pithy summaries of political events and complete worship of the Founding Fathers. But when my seventh-grade social sciences teacher began to talk to us about the death penalty, about the poor in America, I started to learn not only how the government functions, but also how it can improve.

When my teacher brought up in class the issue of a school lunch bill being debated in the school legislature, I took my first step into political activism. This bill exemplified the vast injustice we were learning about in class: while my classmates threw away two-dollar slices of pizza, other students just a few miles from us were struggling to eat. I began spending my lunch and free periods in school calling all the government representatives in the state to urge them to support the bill.

A few weeks later, I was notified that the bill had been ratified; and, although I realized that my phone calls and badgering were not the only reason the bill had passed, I was transformed from an apolitical student to an active participant in the world. I felt I could make a difference.

An Education in Civil Liberties

Since that first foray into political activism, I have been fortunate to have several opportunities to work toward greater social justice and civil rights. Living in a democracy means that political activism is both a privilege and a duty. It is a misconception that you have to wait until reaching voting age to become politically involved. I learned a great deal about political activism before turning 18.

The summer after my junior year of high school, for example, I had the incredible experience of interning at the American Civil Liberties Union (ACLU) of Illinois. I was able to see how civil liberties are threatened, and then defended by the ACLU, on a daily basis. Through the ACLU's High School Education Project, I was also able to pursue my own activist projects. During the summer, I learned how to conduct basic legal research, and was then able to write a *Teen Health Rights Guide*. The other high school interns that summer also researched and wrote publications, focusing on topics such as search and seizure laws and juvenile justice.

While we learned about civil liberties, we also recognized that, unfortunately, many high school students weren't aware of the laws affecting them. Thus, during the fall we coordinated an ACLU Conference on Student Rights, which attracted students from across the Chicago metropolitan area to hear speakers and attend panels on several civil rights and liberties issues, such as "street law" and racial profiling.

Many Paths, One Goal

Although I attended three different high schools, I was able to become active in several social justice projects at each one. Throughout high school, I was involved in Amnesty International, an organization that helps free prisoners of conscience. The simple act of writing letters to the prisoners provided much needed encouragement to them, and letters to leaders and officials frequently led to their release. I also formed a political discussion club during my senior year in order to provide an opportunity to converse about current political events.

Of course, there are many paths for pursuing social justice. Social change can be effected through the arts and writing, in addition to legislation and politics. I witnessed this the summer after my high school graduation, when I interned at a cultural center in Chicago that specializes in social justice-related poetry. After attending several community poetry events, I discovered that true understanding and acceptance, the basis for civil rights, could perhaps be most powerfully cultivated through the arts.

Although students in our generation are often stereotyped as apathetic and oblivious to contemporary social issues, I believe that many of us boast a high level of idealism. We are revolutionizing democracy by using the Internet to communicate with people around the world and continually shattering demeaning stereotypes. While we face many setbacks and much opposition in the process of working towards greater social justice, we should let nothing get in the way of the pursuit of our goals. After all, it is still entirely possible to change the world. ■

David Lau **is a freshman at Yale University, where he plans to major in literature. He continues to be active in social justice projects and writes for several publications. Last year, he was one of 12 students to receive an ACLU Youth Activism Award for his work in defense of civil rights.**

Making a Difference in Your Community, in the World

David Lau became an activist when he was in seventh grade by making phone calls to elected officials. It *can* be that easy to make a difference. The only question is, what do you want to support—or to change? Then, all you have to do is get involved.

Sound simple? It is. Here are just a few ways you can influence the world around you, even before you reach voting age.

- Learn about legislation affecting your community, and write letters, make phone calls, or send e-mails to your elected officials to let them know your opinions.
- Join an organization that does work that you believe in. See page 20 for some ideas.
- Start a chapter of an organization like SADD or Amnesty International in your school.
- Volunteer. Help clean up the streams or parks in your area. Read to children in your local library. Spend your Saturday helping out at a food kitchen.
- You might not be able to vote, but you still have a voice. Write letters to your local newspaper; contact local media when your student group is sponsoring a function. Start a newsletter or e-newsletter. Get your message out there.
- Get involved in student government.
- Add relevant and responsible links to your Web site.
- Make a pledge to yourself by signing the UNESCO Manifesto 2000 at www3.unesco.org/manifesto2000/ Then, by keeping your pledge, be an example to those around you.

A Member of the Board

by Elizabeth Hart

> *Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has.*
>
> — **Margaret Mead**

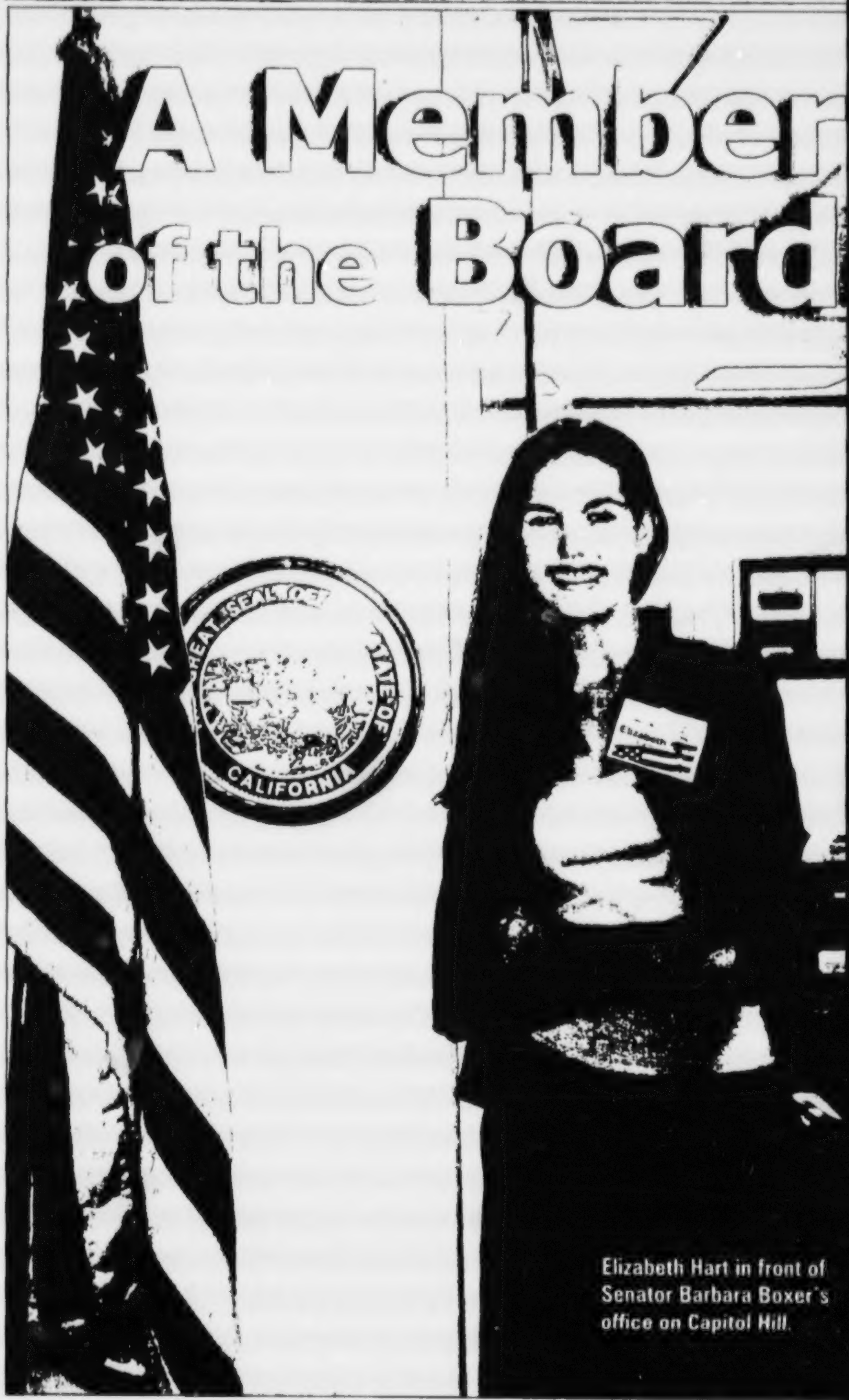
Public education in America needs to be improved. As students, I know you have seen the negative aspects of our current system: underperforming students, disgruntled teachers, and overburdened administrators. At times it may seem as though there isn't anything you can do to make it better. However, the power to change the way your school district is governed is completely within your reach.

The Idea

During the fall of my junior year in high school, I attended the California Student Advisory Board on Education Conference (SABE). As Publicity Director of my school's student government, I saw attending a statewide conference as an opportunity to share ideas with other student leaders and to learn more about California's education policies.

Under the direction of student conference directors and facilitators, about 100 high school students were placed into different discussion groups on topics of their own choosing, which ranged from violence prevention to foreign language education. At the end of the conference, each group submitted a proposal to the California Board of Education.

My group focused on student involvement and input in the educational system. For five days, we researched California's education code, spoke with education experts, and, most importantly, discussed our experiences within our own schools. One of the common threads among our experiences was frustration over student representation within both the school and our respective districts. Students are the only direct consumers of education, yet often we find ourselves unable to communicate our concerns to those who hold decision-making power.



Elizabeth Hart in front of Senator Barbara Boxer's office on Capitol Hill.

My group's proposal recommended that the board "expand California students' ability to influence their education, publicize ways in which students may shape their education, and enforce those existing policies providing students their right to representation in their educational system." But I wanted to do more than just make a recommendation, so I looked for ways to increase student involvement in my own district.

The Plan

A section of the California education code requires district school boards to include one or more preferential voting student members when requested by a petition of 500 students or 10% of the high school students in the district, whichever is less. In other words, a high school student may be elected to serve as a representative of student interest. I made it my goal to seat a student on our district board of education.

The first step in my pursuit of seating a student board member was to circulate a petition throughout all four high schools in my district. I asked friends at neighboring high schools to explain the issue to their friends and to circulate the petition, while I circulated the petition within my own school. We collected 562 signatures in just five days!

The following Tuesday, surrounded by many students who were in favor of adding a student board member, I presented the petition to the board and gave a short speech that explained why I thought the board should seat a student member. Most of the board members seemed willing to seat a student member, but they needed time to put a plan into action.

Setting It in Motion

Several months later, the board formed a committee of students, teachers, administrators, and board members to decide how to seat a student board member. In order to avoid a complicated district-wide election, the committee decided to add four student members, one from each high school. Each school was responsible for choosing its student representative. Since I had led the effort, I volunteered for the position at my school.

The following fall, I found myself seated among the other board members on the dais. Every Friday, I received a packet with pages of information to go over before the Tuesday meeting. I spent hours going over the different issues facing the board so that I could make informed decisions.

I never thought that I would be sitting on the district board of education at 17 years old! At first, the adult board members intimidated me. However, after working with the board, I realized how valuable student input could be. I shared my experiences as a student and provided a student perspective on different issues. My goal was met.

Moving Ahead

That experience became a springboard for other opportunities to promote student involvement in education. While on the board, I was also appointed by the Superintendent to be a member of the district's strategic planning team. That team of parents, students, teachers, and administrators discussed varying issues—from dress code to the increased pressure to meet testing standards—and formulated plans to meet future goals.

I was also asked to assist the director of the California Student Advisory Board on Legislation in Education Conference (SABLE). As at SABE, students participated in discussion groups on different education topics. But at the end of this conference, each group submitted a proposal to the California Legislative Committee on Education, not the California Board of Education.

Elizabeth's SABE group on the California capitol steps in Sacramento.

I was responsible for the logistical portion of the conference: scheduling, food, materials, staff lists, and room assignments. It was a change of pace from simply attending a conference. I never realized how much work goes into organizing a conference!

Through each of my positions, I gained invaluable experience. Not only did I work with intelligent and hardworking adults, but I also learned the benefits of political service.

I challenge you to find ways to influence your education, to find issues that are important to your fellow students, and to communicate those concerns with those who can make positive changes not only for you, but for your peers and the future students of your school, district, and state. I'm glad I did. ■

Elizabeth Hart **is a freshman at the University of California–Berkeley, where she is a member of Kappa Kappa Gamma and Berkeley College Republicans. Education will always be important to Elizabeth, and she plans to be involved at the school board level again as an adult. Anyone interested in seating a student board member is welcome to send her e-mail at eahart@uclink.berkeley.edu**

Hearts AND Mines

JOINING THE FIGHT AGAINST LANDMINES

Photograph by Lee Si Woo (www.siwoo.pe.kr)

by Auguste Dutcher

What would you do if you learned that there was a landmine buried somewhere in your neighborhood? It could be in a field, or a road, or even your schoolyard. How would you feel about walking to school or to a friend's house? Imagine the terror your mother would feel whenever you went outside. Imagine that this was your daily life.

Sadly, millions of children do not have to imagine this scenario. They live it. And they know that there is not just one landmine buried nearby, but tens or even hundreds. The most heavily mined countries in the world—Bosnia-Herzegovina, Cambodia, Croatia, and Afghanistan—have an average of over 100 landmines per square mile. There are currently 60 to 120 million landmines buried around the world. Every year, 25,000 people and half a million animals are maimed or killed by them.

If you're like I was a year ago, you're asking, "What can I do to help? I'm just a kid." The truth is, you can help, as I found out.

Learning about Landmines

As I sat with the other students in my Unitarian church youth group, waiting for our first meeting of the year to begin, we wondered what we would accomplish in our "social justice" year of Sunday school. The Unitarian church has a strong history of social activism, but we weren't expecting much activity that day. We assumed it would be just another lecture about all the problems in the world that need solving. We didn't imagine that we would actually become a part of solving some of those problems.

Our teacher began by asking us what was important to us, and how we thought we could contribute to the goal of social justice. We talked about volunteering in our community and raising funds to support causes we could not directly assist. But how would we choose which causes to contribute to? There were so many that seemed to need all the support we could give. We needed to learn more before making our choice.

One cause we wanted to know more about was landmines. Our research was heartbreaking. We learned that someone is maimed or killed by a landmine every 20 minutes. Children are more likely than adults to be killed by landmines because, with their smaller bodies, they are closer to the center of a blast and so are more severely injured. They also bleed to death more quickly. Among those who survive, few receive prosthetic limbs to replace the ones they have lost. In Cambodia, one out of every 240 people is now an amputee. We also learned that landmines cause loss of more than life and limb. Farmers cannot plant crops in mined fields, and mined roads prevent the safe return of refugees and impede the delivery of food and aid. Landmines kill in many ways. And once in the ground, a mine can remain active for 50 years.

After doing our own research, we invited guest speakers to inform us further about the causes we had begun to focus on. One speaker was the head of our church's Adopt-A-Minefield (AAM) chapter. We watched a video about de-mining and learned why it is so dangerous and expensive to clear an area of landmines. While the average cost of a landmine is only $3 to $30, it costs $300 to $1,000 to clear a single mine. One of the major expenses is training the most useful workforce in the de-mining project: dogs. They are trained from a young age to sniff explosives. Many landmines are now made of plastic so that they cannot be detected by metal detectors. Because dogs smell the explosives, not the casing, they can detect plastic as well as metal mines.

We decided to join our church's AAM effort and got to work. After many Sundays of hard work at bake sales, raffles, and raking leaves for members of the church congregation, our team of only 13 students raised over $1,150. The money we raised was added to funds raised by other Unitarian churches across the metropolitan Washington, DC area. Together, our community raised around $30,000—enough to clear one minefield. The money was sent to the United Nations, who decided where the funds would be used. A few weeks later, we learned that our contribution would be used to clear a minefield in Afghanistan. After a minefield is cleared, it can finally be used again by the local community for farming or herding. That is certainly priceless to the people who live there. We were all very proud of what we accomplished.

Postscript

Four months later, the September 11th attacks transformed Afghanistan from a forgotten corner of the world to front-page news. Communication from Afghanistan suddenly shut down, and in that period of confusion, we received word that "our" minefield had not been cleared. We were relieved a few days later when we heard that it had been cleared just before the attacks. We only hope that no new landmines will be buried there as part of the current war.

If you, too, are disturbed by landmines, I strongly encourage you to get involved in such a project. You cannot imagine how rewarding it is. You *can* make a difference. ■

An eighth grader at The Woods Academy in Bethesda, MD, *Auguste Dutcher* lives outside Washington, DC, with her mother, father, and pets. She enjoys playing guitar with her dad, hanging out with friends, and playing with her cat and hedgehog.

To Learn More or to Help

Adopt-A-Minefield, a program of the United Nations Association of the United States, seeks sponsors to adopt minefields that the UN has identified as being in urgent need of clearance. Every dollar raised is given to the UN for mine clearance. *www.landmines.org*

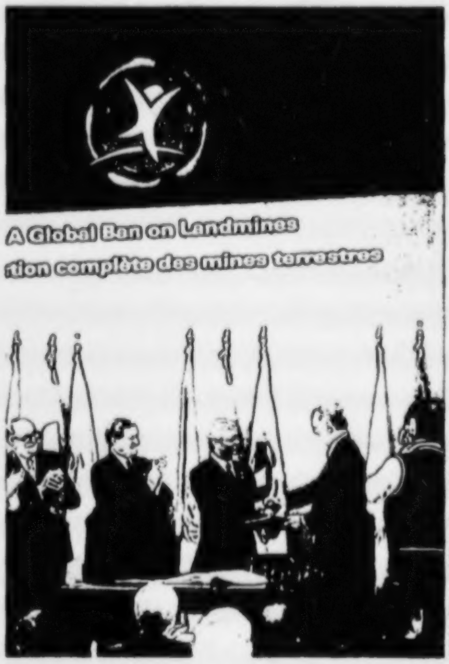
International Campaign to Ban Landmines, recipient of the 1997 Nobel Peace Prize, is an advocate for landmine clearance, landmine victim assistance, and an international ban on the production and use of landmines. *www.icbl.org*

Landmine Survivors Network provides medical care, physiotherapy, and psychological counseling for landmine victims. *www.landminesurvivors.org*

International Mine Ban Treaty

The 1997 Ottawa Convention banning the manufacture, distribution, and use of landmines has been signed by 142 nations. While President Clinton announced support for a comprehensive ban on anti-personnel landmines (APLs), the United States—along with Russia, China, Cuba, Iran, Iraq, Libya, North Korea, and Somalia—refused to sign the treaty. The U.S. still relies upon landmines to help maintain the border between North and South Korea. In 1998, the U.S. stated that it would sign the treaty in 2006 if it is successful in developing alternatives to APLs.

For more about the Mine Ban Treaty, see www.icbl.org


A Global Ban on Landmines
tion complète des mines terrestres

UN/DPI Photo #190364 by Evan Schneider

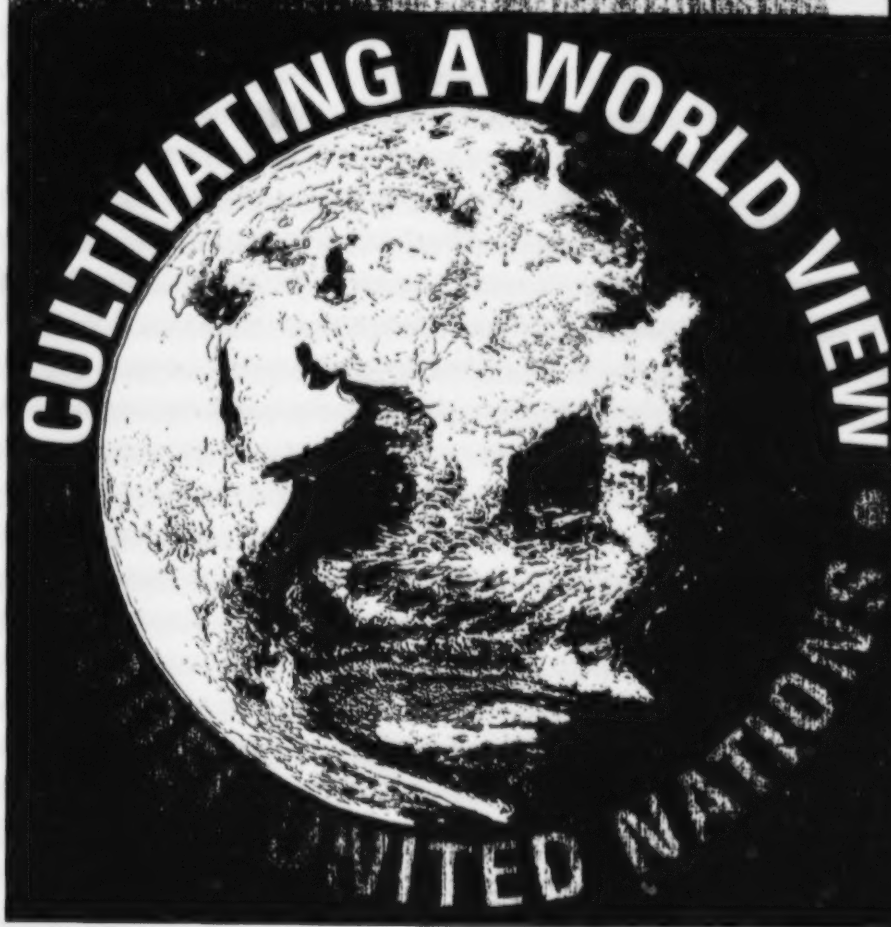
Prime Minister Jean Chrétien of Canada and UN Secretary-General Kofi Annan (center) at the Ottawa Convention during the Treaty Signing ceremony of the new humanitarian law treaty totally banning anti-personnel mines.

If you could address the United Nations, what would you say about human rights? The environment? Economic development? What if you were speaking not for the United States, but for Congo, or Bahrain?

In this article, Emiliano Martin De Luca discusses Model UN, an exciting program that allows students to role-play diplomats from around the world. The rewards, according to Emiliano, go beyond the fun of simulation.

CULTIVATING A WORLD VIEW

by Emiliano Martin De Luca



I first heard about Model UN two years ago, while I was living in Argentina. In April 2000, my school received an invitation to the Harvard National Model UN (HNMUN), to be held that December. Our school didn't have a Model UN team, but as soon as I heard about the opportunity, I knew I wanted to be a member of that delegation.

I had become interested in diplomacy as a result of traveling with my father on business trips that took him around the world. I wanted to travel, to learn and live in different cultures. And I was also fascinated by government officials and the power they have to decide a country's policies and affect the future of its citizens. Model UN, I realized, would give me a chance to explore diplomacy while still in school.

In the Shoes of Croatians

All I knew about the United Nations was that they were headquartered in New York. I immediately read everything I could find about the United Nations, the international community, and Croatia, the country our school would represent at HNMUN.

Once our delegation was assembled, we met once a week for very serious meetings, which we conducted entirely in English. We memorized parts of the UN charter, monitored Croatian news every day, and even visited the Croatian Embassy in Buenos Aires. All of this research helped us to step in the shoes of Croatians, to act and think like them.

MUN conferences are divided into committees or organs, such as the Commission on Human Rights, Security Council, Legal Committee, and many others. We knew well in advance which committees we would be serving on; for example, I would serve on the Organization for Security and Cooperation in Europe, which would discuss topics like relations with NATO and freedom of the press in Europe. Knowing our committees and topics helped focus our research even more.

In August, however, my family was moving to the United States. I learned not only that I could still attend HNMUN with my school, but also that our advisor had appointed me Ambassador of Croatia—head of the delegation. I was thrilled to have my first leadership assignment. I stayed in touch with my team like embassies stay in touch with their home governments: by e-mail, fax, and phone.

First-Time Diplomacy

When December rolled around, I was reunited with the rest of my delegation at the HNMUN, which I soon realized was a serious and challenging conference with more than 2,200 delegates from every continent.

In my committee, Organization for Security and Cooperation in Europe, the other delegates were aggressive and experienced negotiators. Since this was my first conference, the level of discussion exceeded my expectations. I was able to argue effectively for Croatia's interests, but I was learning a lot from the skills and styles of the other delegates.

One thing I realized right away was that compromise and persuasion go hand in hand. Of course delegates would love to have their resolutions passed exactly as written, but they often have to work with delegates from other countries—not even always their traditional allies—to create something that they can agree on. Diplomacy is more than just trying to make people agree with you; it's learning to see more than one side.

Revisiting Argentina

While still preparing for the HNMUN, I had joined my new school's Model UN team at the beginning of the school year. I asked and was assigned to serve as the Political & Security Delegate of Argentina at a conference that our school would attend in January. I was excited to represent my native country, but I still had to do a lot of research to learn about Argentina's foreign policy.

My experience at the HNMUN helped me enormously as I prepared for this conference. This time, I would be serving on a committee that would discuss light arms trafficking, AIDS as a security threat, drugs trafficking, and the Cyprus question. I felt that the most important topic for Argentina was light arms trafficking.

Before I even arrived at the conference, I found potential allies, including Brazil, Spain, and Italy, through my research of Argentine foreign policy. I drafted a resolution against light arms trafficking before arriving at the conference; during caucus, I presented this resolution to the Latin American countries and, later, to the United States and other European powers. We built an alliance based on our common interest in stopping and preventing small conflicts within our nations' territories. The resolution passed, with only Libya, Iraq, Iran, China, and North Korea voting against it.

Beyond Simulation

My experience continued expanding as I attended more and more conferences. In July I attended the Model UN Summit in New York, which brings together MUN experts from over 30 nations each year. There I met Dr. Lucia Rodriguez, Education Director of the United Nations Association of the USA, who would eventually offer me an internship with UNA-USA. This internship took me back to Argentina, where I presented a project called Global Classrooms, a program we hoped to initiate in Argentine high schools. In my trip to my native country, I held meetings with government and non-government officials, moving to a level beyond a simulation.

Today, a year and a half after my introduction to MUN, I am president of my school's MUN team, Assistant to the Director of Education for Regional Summits at UNA-USA, Press Secretary to the Youth Governor of New Jersey, and General Assembly President of the Internet MUN (www.minu.org). I have also made strong friendships with kids from Argentina, Colombia, Mexico, Russia, Venezuela, Dominican Republic, China, Yugoslavia, and many other countries. It has been exactly the experience I hoped it would be, one on which I will continue to build in college and, I hope, in my future career. ■

DISCOVER DIPLOMACY FOR YOURSELF

It's easy for high school students to get involved with Model UN. If your school doesn't have a Model UN class or team, consider starting a club. All you need is a faculty adviser and some interested members to start planning for conferences. For more information, including tips on getting started, explore these Web sites:

United Nations Association of the USA
www.unausa.org/programs/mun/

United Nations Model UN Discussion Area
www.un.org/Pubs/CyberSchoolBus/munda/

Emiliano Martin De Luca is a senior at Cranford High School in New Jersey. He is currently writing a book called *American Interventions Overseas, 1950-2001*, with the help of his MUN adviser. After college, he hopes to serve as a diplomat with the Foreign Service, work at the White House, and someday to become one of America's great Secretaries of State.

LIVING GOVERN

AT THE NATIONAL YOUNG LEADERS CONFERENCE

by Micah Joiner

When I received my invitation to attend the National Young Leaders Conference (NYLC) in Washington, DC, I thanked my English teacher who had nominated me and eagerly began preparing for the trip. It was a great honor to be selected. The NYLC brings together 350 high school students from all over the United States to sharpen their leadership skills and political awareness. I expected that it would be a wonderful trip both intellectually and socially, and I wasn't let down.

When I arrived at the National 4-H Center, my home for the next 11 days, I was given room keys, a map of the campus, and a schedule. The schedule varied widely in events: challenging simulations, unforgettable sightseeing, and meetings with politicians. For the majority of the conference, we were divided into Leadership Groups of about 20 kids each. It was in these groups that we participated in most of the simulations.

We learned about the executive branch of government by acting as members of the Presidential Cabinet in an international crisis. In our simulation, we had to react to a crisis between China and Taiwan. China wants supreme control of Taiwan, a smaller country that is fighting for its independence. The Cabinet must choose the U.S.'s plan of action carefully: We have promised to protect Taiwan, but we are reliant on trade and diplomatic relations with China. After much discussion, we decided to strengthen our military deterrence (to show both sides that the U.S. wasn't going to take a passive role) and hope for a negotiation. This simulation showed me how tough the decisions are that face the Presidential Cabinet.

Simulating the Presidential Cabinet at NYLC.

Another simulation taught us about the judicial process. As a Supreme Court Justice, I listened to the arguments of the Good News Club, an organization that promotes after-school prayer groups on school grounds, and Milford Central School, whose administration felt that such groups violated the separation of church and state. After listening to much debating, cross-examining, and rebutting, our Supreme Court ruled in favor of the Good News Club because the meetings were held after school and the children weren't forced or persuaded to attend. At times the discussions were difficult to listen to because so many opinions conflicted with my own beliefs. But I'm glad to say that I learned how to make objective decisions based on the law instead of my personal feelings.

NYLC students vote on an amendment during Model Congress.

Our largest (all 350 conference participants) and final simulation, Model Congress—held in the Cannon House Office Building, a real House of Representatives building—familiarized us with the legislative process. Divided into committees and caucuses, we role-played congressional leaders and proposed and tried to pass legislation. I was a member of Caucus B, which was trying to pass an amendment to a gun control bill. I was our group's testifier, and I proposed private funding, as opposed to government funding, for firearm safety education. I felt so liberated after my speech, and for good reason: Our amendment passed!

But we didn't just simulate these governmental procedures. We got to see politicians in action. I met my state's representative, Congressman Cooksey of Louisiana. I spent almost two hours asking him questions and following him

MENT

around the Cannon House Office Building. I also heard from U.S. Representative John Shimkus from Illinois.

We also did a lot of sightseeing in Washington, DC, which further deepened our political understanding. We walked through the Vietnam and Korean War Memorials. We saw the changing of the guard in the Arlington National Cemetery. But my most memorable day of sightseeing was when we visited the Lincoln, Jefferson, FDR, and Iwo Jima Memorials. The atmosphere was so patriotic, it would have been impossible to leave the grounds without a deeper love and pride for my country.

The NYLC taught me so much more than just American government. I learned how to make good choices, how to be open-minded, and the importance of solid teamwork. Most of all, I learned the true meaning of being a citizen—of my state, my country, and my world. ■

Micah Joiner is a senior at Alexandria Senior High School in Louisiana. She is heavily involved in her church organization and school activities. Her favorite subjects are English and history, and she loves to participate in music, art, and theater. Micah plans to continue her education close to home and to major in graphic design.

NATIONAL YOUNG LEADERS CONFERENCE

The Congressional Youth Leadership Council (CYLC) sponsors the National Young Leaders Conference (NYLC), a leadership program designed to educate and inspire students to fulfill their roles in the American democratic process. Participants travel to Washington, DC, for one of 16 six-day sessions held throughout the year or for one of four 11-day sessions held during the summer. High school sophomores, juniors, and seniors may either be nominated for selection by teachers, administrators, or NYLC alumni, or apply directly to the NYLC for an achievement nomination.

CYLC also sponsors the Global Young Leaders Conference, a 12-day program that brings together students from all over the world to explore global communications, diplomacy, peace and security, economics, law and human rights, and the role of the United Nations. *(202) 638-0008 or www.cylc.org*

RELATED PROGRAMS IN GOVERNMENT & LEADERSHIP

Boys State/Boys Nation and Girls State/Girls Nation

Students who have completed their junior year in high school may be nominated (boys by their local American Legion chapter and girls by their local American Legion Auxiliary) to attend Boys State or Girls State, which are held on college campuses throughout the country. Participants engage in mock legislative sessions, campaigning, rallies, debating, and voting. Two outstanding participants of each program will be selected to attend Boys Nation and Girls Nation. *Boys State/Boys Nation: www.legion.org/events/evt_bs.htm*
Girls State/Girls Nation: www.legion-aux.org/programs/docs/qstate/ qstate.html

Close-Up Foundation

Middle- and high-school students learn about the democratic process in 4- or 5-day residential programs, where they participate in tours, seminars, and workshops in order to gain knowledge and understanding of our government in action. *(800) 256-7387 or www.closeup.org*

Georgetown University International Relations Program

This intensive 8-day program for high school students combines lectures by members of Georgetown's faculty and guest speakers, visits to organizations involved in foreign policy, small group discussions on current issues, and an international crisis simulation. *(202) 687-5719 or www.georgetown.edu/ssce/spp/hsir.htm*

The Junior State of America

An organization for high school students interested in politics, government, law, and debate, JSA sponsors conventions and other events during the school year for its members. Members and non-members may also attend JSA 3–4-week summer programs as well as JSA Symposia, 4- or 5-day immersions in the world of politics. *(800) 334-5353 or www.jsa.org/summer/school*

National Student Leadership Conference

NSLC offers five summer courses (6–11 days) for high school students: Mastering Leadership, Law & Advocacy, International Diplomacy, Medicine & Healthcare, and Business & Technology. College credit available. *(800) 994-6752 or www.nslf.org*

United States Senate Youth Program

This program brings two high school students from each state to Washington, DC, for one week to observe the federal government in action and meet key officials. Students visit Capitol Hill, the White House, State Department, Supreme Court, and Pentagon, and also tour Washington landmarks. In addition, delegates are awarded $2,000 scholarships. *(800) 841-7048 or www.hearstfdn.org/ussyp/*

Washington Workshops

A week-long Congressional Seminar (offered three times a year), a week-long summer Diplomacy and Global Affairs Seminar, and a 3- or 6-week summer Advanced Congressional Seminar/Capitol Hill Internship are offered to high school students. Junior/middle school students may choose from week-long seminars offered January through June. *(800) 368-5688 or www.workshops.org*

YMCA Youth & Government

During the school-year Y&G program, 10th-, 11th-, and 12th-graders serve as delegates who write bills, role-play state government positions, attend conferences, and, at the end of the season, participate in a model legislature at their state's capitol building. Contact your state YMCA, which you can find at *www.ymca.net*, for more information.

Love to Argue?

Consider Mock Trial

by Virginia Fisher

Mock Trial is the club for people who like to argue. Over the year, this bunch of amateur arguers will learn not to bicker or fight, not to blather or clam up, but to argue well and convincingly. They learn to talk like lawyers.

Mock Trial is organized by the American Bar Association and individual states' bar associations. Every year, each state issues a case that teams will use for all competitions that year. The documents we receive provide all the necessary information to prepare both a prosecution and a defense team to argue this hypothetical case. We receive a statement of stipulated facts—meaning that both sides have agreed that they are true—describing the circumstances and the question of the case; six witness statements—three for defense and three for prosecution; and several relevant documents that can be used as evidence.

Last year, the case involved a chemical company that donated land next to its plant to an environmental education and advocacy group. Hundreds of barrels of toxic waste were later found on the land, and the chemical company was accused of dumping them. Our team of 11 teenage girls took on the roles of a toxic waste hauler, a state investigator from the Environmental Crimes unit, a CEO, an environmental advocate, and their legal counsels—roles we would keep for the entire mock trial season.

Our coach is a former lawyer who encourages us very strongly at every point. That's a nice way of saying that we end up spending seven hours a week in mock trial meetings, with assignments in between. One weekend, shortly before our competitions started, we even held a mock trial sleepover. We arrived at our coach's apartment, ordered Chinese food, and started rehearsing direct examinations. (Nothing goes with lo mein quite like a good hearsay objection!)

We also played mock trial Trivial Pursuit, where the game's questions were replaced with details about the case. The case was about 40 pages long, so there were plenty of details. Later, we watched *My Cousin Vinnie*. It's the best law movie there is, with lots of juicy courtroom examples and just as many examples of what not to do.

Despite all the preparation and team building, disaster occasionally strikes. One Thursday, we were scheduled to compete against our rival school, Columbia, at the county courthouse. That Wednesday, Erin, our team's prosecuting attorney, got sick and had to go home. We wouldn't know until we got to the courthouse which side we would be representing, but, if the coin toss said we would represent the state, we would need a prosecuting attorney. As Erin's counterpart in the case, the defense attorney who examines the same witnesses from the opposing side, I was the obvious choice to take her place.

Erin had rehearsed to present the opening statement, a summary of the evidence to be presented in the case. Fortunately, she had left notes, and the witnesses knew their parts well. Between the time school ended at 3:30 and the time we left for the competition at 5:00, I copied her notes onto index cards and read them over and over to a chair in the hallway. "Your honor, we are here today because of greed and a company who put profits above people and money above safety."

Because the prosecution has the burden of proof—the chemical company was innocent until proven guilty—they give their opening statement first and their closing statement last. The opening statement sets the tone for the rest of the case, and, if you take control immediately, speaking first is an asset. I was wondering if I would be able to get any words out at all.

"Your honor, my name is Virginia Fisher, and these are my co-counsels, Maha Jafri and Amber Crowley. We represent the state here in the case People of New York v. Monk Agricultural Chemical Company, Jefferson Monk and Taylor Monk." My voice sounded strained and far away, but at least I hadn't made a mistake on which side I was representing. I finished the opening, then sat down and listened to the other team's opening statement.

The witness examinations were easier, since I'd been practicing with these people already and knew their statements. The case was close. The Columbia team argued over the fine, technical points of the records kept by the toxic waste hauler employed by the chemical company. I knew exactly what they were trying to do, because I would have been doing the same thing if we were arguing the other side. But our team didn't need to argue the technicalities; we had good evidence and strong witnesses on our side. I examined our witnesses and cross-examined witnesses for the defense. Then, all I could do was wait for the decision.

We did win that case. But for me, winning is only a small part of the allure of Mock Trial. I love the competition, the adrenaline, the tension, and the feeling of arguing a case well.

I've been involved with Mock Trial since my freshman year. I like it because it's a way of thinking. It combines acting and logic and language and competition. With hard work, our team has created winning cases by bringing all of these elements and skills together. With hard work, we have learned how to argue, and argue well. ■

Virginia Fisher **is a junior at the Emma Willard School in Troy, NY, where she is on the varsity crew and j.v. soccer teams, a member of the drama club, and a reporter for the school paper. She has also won gold medals in the Russian Olympiada and Russian Essay contest.**

To learn more about Mock Trial, visit the Web site of your state's bar association, go to **www.nationalmocktrial.org** ***(where you can find your state coordinator), or contact Dee Runaas, State Bar of Wisconsin, 5302 Eastpark Boulevard, Madison, WI 53718; (608) 250-6191.***

A JURY OF YOUR PEERS:
TEEN COURT

In the 1960s, a handful of communities started using a program that they thought would provide a good alternative to the traditional juvenile justice system. Instead of formally going "into the system," first-time youth offenders would have their cases heard by their peers. A jury of teens would then impose sanctions, such as community service, on the offenders. Teen Court was born.

Since the '60s, the number of Teen Court programs has increased to more than 800, with 45 states administering such programs (also called Youth Court and Peer Court). The programs vary in their courtroom models and the degree of teen participation, but all have the goal of reducing recidivism, improving attitudes toward authority, and increasing knowledge of the justice system.

In some states, teens participate as defense and prosecuting attorneys, court clerks, bailiffs, jurors, and even as judges. In others, adults serve as judges. But in all programs, it is the teens who decide on the appropriate sanctions. Most Teen Courts hear only cases of first-time offenders who have committed minor offenses, such as vandalism, shoplifting, or disorderly conduct; sanctions include writing letters of apologies to victims, performing community service, attending classes, or even serving jury duty in a subsequent Teen Court.

Unless you live in Connecticut, Maine, Massachusetts, New Jersey, or Rhode Island, you live in a state with a Teen Court program. To learn how you can participate: National Youth Court Center, c/o American Probation and Parole Association, P.O. Box 11910, Lexington, KY 40578-1910; (859) 244-8215; nycc@cgs.org; www.youthcourt.net

The Culture of Debate

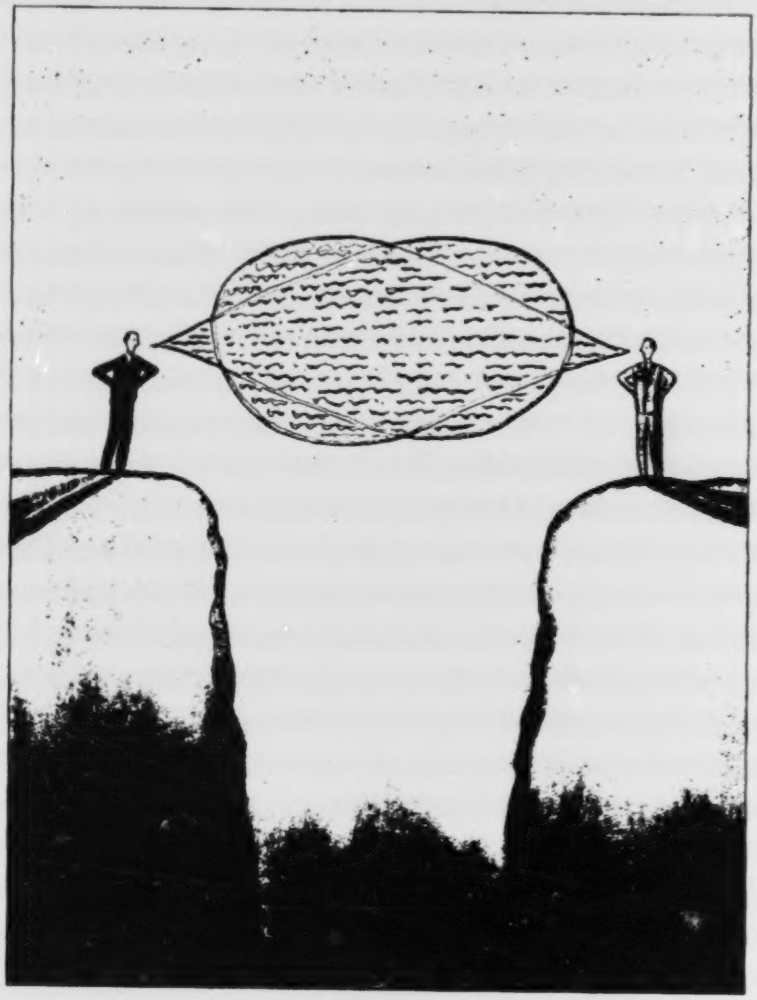
by Robert Samuels

I can still feel the sweat on my palms at the semifinal round in the Junior Varsity State Championships against Hostos-Lincoln Academy in April 2000, as I tried to bring home the winning argument: "When we start making plans to build a National Missile Defense, the Chinese will become upset that we are destroying the doctrines of deterrence and Mutually Assured Destruction by giving us first-strike capabilities. Since they do not want us to destroy these doctrines, they will attack us before we finish building the NMD and when they attack us, we'll all die! Vote affirmative!"

Enter the world of competitive debate.

Policy Debate 101

When I entered Bronx Science High School as a freshman, I knew I wanted to join the school debate team. The coach threw me into the loud, quick paced, brash world of policy debate (known in some places as cross-examination or team debate), a two-on-two event that focuses on one topic a year. This year's topic is "Resolved: That the United States federal government should establish a foreign policy significantly limiting the use of weapons of mass destruction." Two teams, affirmative and negative, debate the topic. Because you don't find out until the tournament which side you'll take, you must be prepared to argue on either side.



The affirmative team must prove why and show how the federal government should adopt a course of action. For example, to prove that the resolution should be adopted, my partner and I present the case that the United States and Russia might accidentally launch their nuclear missiles, killing billions of people. To show how this resolution could be enacted, we prove that we can prevent an accidental launch by separating the nuclear warhead from the launch vehicle. The negative team must disprove the ideas of the affirmative team, thereby negating the resolution. The negative team contests that the status quo world is a better world than one where the affirmative plan is passed.

Research: The Neverending Task

One of the most important things debate has taught me is the importance of research and preparation. Many debaters spend as long as ten weeks at debate institutes during the summer. At these camps, students prepare intensively for the next year's topic and try to perfect their debating skills. Students and their lab leaders (usually former high school debaters) think about different ways that an affirmative team can prove that the resolution should be adopted, as well as how the negative team could disprove the affirmative. After camp, a debater typically comes home with five to ten thousand pages of research for the next debate resolution.

Not content with the research done at camp, we usually search the Internet (from the free google.com to the expensive Lexis-Nexis Universe) weeks before the next tournament for the most recent evidence concerning positions in a debate.

Since the research must actually be read in the debate, a debater has to speak quickly to make certain that all the evidence needed to win the round is presented. The result is the trademark of team debate, the "spread," where debaters speak at about 400 words per minute (that's no exaggeration) to address all the points that need to be addressed.

The Tournament Circuit

Tournaments are usually held on weekends. The Bronx Science schedule is quite rigorous with competitions three weekends a month. A tournament consists of three to seven preliminary rounds where all teams compete. After the preliminary rounds, a very small fraction of teams advance to single-elimination rounds. At the end of the tournament one team remains: the championship team.

Tournaments vary in difficulty and prestige. The local and regional tournaments are for younger debaters and are less prestigious. Juniors and seniors who do well in their localities will most likely attend the State Championships, the NFL (the National Forensics League, which existed before the *other* NFL) Championships, and the Catholic Forensic League Grand National Championship. The national tournaments, including the University of Redlands Tournament in California, the Glenbrooks Tournament in Illinois, the Montgomery Bell Academy Tournament in Nashville, and tournaments at Emory and Harvard Universities, are more selective. Doing well at the national tournaments assures a team a bid to the Tournament of Champions in Kentucky, the Super Bowl of Debating.

Cult ... or Culture?

Some cynics have told me that debating is actually an underground cult, citing the myriad debate Web sites, debate shorthand, debate slang, a massive national e-mail listserv, debate movies, debate magazines, debate jokes, and debate computer games. But while most high school cliques are exclusive, debate

Continued on page 18

Other Forms of Forensics

Lincoln Douglas/Values Debate
One-on-one debate with the topic changing every two months. The resolutions are typically framed "That value A is better than value B." At the end of the round, the judge votes on which value is better justified.

Worlds Debate
A three-on-three debate with the topic changing every round. The resolutions are typically framed, "This house believes in ________."
This type of debate is not done competitively in the United States, except for those competing on the international level.

Student Congress
Several students in an "every person for themselves" format debate bills and resolutions, as would the actual Congress. Imagine watching C-Span with people half the age.

Competitive Speech
Either by themselves or in a duo, students memorize and perform excerpts from plays, television shows, or speeches given in public. In extemporaneous speaking and original oratory events, students perform speeches they have written.

—Robert Samuels

The 2001-02 Bronx High School of Science Debate and Speech Team tends to be inclusive. My experience with debate has demonstrated nothing but tolerance of all people and cultures. All of its participants become a part of the same society: the debate society.

As a community, debate is active—and even activist. Immediately after the tragedy of September 11, the Wake Forest University Forensics society still held its tournament, actively protesting the attempts of the bombers to disrupt American normalcy. At world tournaments, like the World Championship in South Africa, I witnessed the upper class of Rosebank trying to introduce and promote debate to the downtrodden people of Soweto.

I value debate for many reasons. The intense practice and research sessions have taught me to manage my time, my academic work, and my social life (during the school year, I spend about 60 hours a week on debate alone). Through debate, I have learned how to speak confidently and to organize my ideas. It has helped me find my voice. ■

Robert Samuels is a senior at the Bronx High School of Science, where he is a fourth-year debater and president of the Debate and Speech Team, which is the sixth-largest in the nation. In 2000 and 2001, he finished third in Policy Debate at the New York State Championships. He also competed with the United States International Debating Team at the World Schools Debate Championships in Johannesburg, South Africa, where they finished a respectable tenth place.

SELECTED DEBATE RESOURCES

SUMMER PROGRAMS

In preparing for this issue, we learned about dozens of summer programs in debate. Space constraints prevent us from listing them all here; you can find links to these and many other programs on our Web site: www.jhu.edu/gifted/imagine

Bates College Summer Forensics Institutes
Grades 9–12; 1–3 weeks; focus on policy, L-D, or individual events.
http://abacus.bates.edu/admin/offices/spsp/summer/debate/

Capitol Classic Debate Institute
Grades 9–12; 3-week session for debaters from novice to varsity, 4-week session for advanced only.
http://summer.cua.edu/debate

Dartmouth Debate Institute
Grades 9–12; 4 weeks; focus on policy debate.
www.dartmouth.edu/~debate/workshops.htm

Emory National Debate Institute
Grades 9–12; 2 weeks; focus on L-D or policy debate.
www.emory.edu/ENDI/

Michigan State Spartan Debate Institute
Grades 9–12; 2 or 3 weeks; focus on policy debate.
www.msu.edu/~debate

Northwestern Coon-Hardy Debate Program
Grades 10–12; 4 weeks; focus on topic analysis, argument, and strategy development.
www.northwestern.edu/nhsi/main/debate/debate.html

Stanford National Forensic Institute
Grades 9–12; 3 weeks; policy, L-D, individual events, or communication lab; extended week programs available in policy and L-D.
www.snfi.org

University of Iowa National Summer Institute in Forensics
Grades 9–12; 3 weeks; focus on policy or L-D.
www.uiowa.edu/~provost/summer/forensics.htm

University of Texas National Institutes in Forensics
Grades 9–12; 2–3 weeks; focus on team, L-D, or individual events.
www.utexas.edu/coc/cms/utnif

Wake Forest Debate Summer Workshop
Grades 9–12; 3 weeks; focus on policy debate (with optional 1-week extensions) or debate generics and theory.
www.wfu.edu/Student-organizations/debate/WorkshopSummer/WorkshopIndex.htm

WEB SITES

Debate Central
www.debate-central.org

Debate Information Center
www.debateinfo.com

Free Speaker
www.freespeaker.org

National Catholic Forensic League
www.ncfl.org

National Forensic League
http://debate.uvm.edu/NFL.html

Selected Resources in LAW & POLITICS

COMPETITIONS

National History Day
Students conduct extensive research on a topic of their choice that relates to the year's theme and then present their findings in papers, exhibits, performances, or media presentations. Students in two divisions—junior division (grades 6–8) and senior division (grades 9–12)—may enter their work in one of seven categories. The top three winners in each category win $250, $500, and $1,000; other prizes include $5,000 cash awards from The History Channel, and full- and partial-tuition scholarships. Check with your state coordinator (listed on Web site) for deadline. District contests are usually held in February or March. *(301) 314-9739 or www.nationalhistoryday.org*

The Ralph Waldo Emerson Prize
To be considered for the Emerson Prize, students must first have their history essay published in *The Concord Review*, the prestigious quarterly journal that showcases the scholarly work of high school students. The four authors of the year's best essays win $3,000 each.

Submission form and guidelines are available on the Web site. *(800) 331-5007 or www.tcr.org*

We the People ... The Citizen and the Constitution
Students in elementary school through high school participate in this civics education program in the classroom. For high school students, the culminating activity is a competitive simulated congressional hearing. Students compete at the district and state levels before advancing to the national finals in Washington, DC. *(800) 350-4223 or www.civiced.org/wethepeople.html*

TALENT SEARCH SUMMER PROGRAMS

In addition to other courses in science, mathematics, and the humanities, the talent searches offer several courses related to law and politics. Call or visit their Web sites for specific qualifying information.

See page 13 for additional summer government and leadership programs, and page 18 for summer debate programs.

Center for Talented Youth
CAA and CTY, grades 7 and up; 3 weeks. CTY courses include Law and Politics in U.S. History and Geopolitics. CAA courses include The Civil Rights Movement and Great Cases: American Legal History.

CTY, grades 2–6; 3 weeks. Humanities courses include Model United Nations and Advanced Geography. *(410) 516-0337 or www.jhu.edu/gifted*

Center for Talent Development
Apogee, grades 4–6; 3 weeks. Courses include Community Action: Active Citizenship in American Democracy and Order in the Courtroom: Law and Fairy Tales.

Spectrum, grades 7–9; 3 weeks. Courses include International Relations and Order in the Courtroom: Constitutional Law.

Equinox, grades 10–12; 3 weeks. Courses include Middle Eastern Politics and Modern Political Thought. (847) *491-3782 or www.ctd.northwestern.edu*

Duke University TIP
Academy and Center classes, grades 7–10; 3 weeks. Academy courses include International Relations and Politics, and Economics: A World View. Center courses include Campaigns and Elections, Global Responsibilities: The U.S. in World Politics, Controversial Politics: Revolution and Terrorism, Law and Political Speech, Constitutional Law, and International Relations. *(919) 684-3847 or www.tip.duke.edu*

Rocky Mountain Talent Search
Ages 11–15; 11 or 20 days. Courses include Global Issues & Conflict and Mock Trial & Critical Thinking. *(303) 871-2983 or www.du.edu/education/ces/si.html*

INTERNSHIPS

The following internships give students exposure to politics, social activism, and even international relations. But you can also learn a lot about politics and law by volunteering or interning right in your own community. Call offices of local officials, law firms, and political organizations to inquire about opportunities. Also check out **Peterson's Internships 2002** *for opportunities for high school students (the academic level index makes them easy to find).*

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Photo courtesy of Junior State of America

Amnesty International
Amnesty International, a worldwide human rights organization, offers several opportunities for high school interns and volunteers at its offices around the country. Visit the Web site for a current listing of opportunities and for phone numbers of offices in your region. *www.amnestyusa.org/contact/volunteer.html#hre_mw*

Common Cause
This nonprofit lobbying organization, which works to promote "open, honest and accountable government," offers internships to high school students in which they work on organizing grassroots efforts. Offices are located in Washington, DC. *(202) 833-1200 or www.commoncause.org/about/intern_positions.htm*

Congressional Page Program
Juniors in high school may apply for one of the 30 federal page positions available during the summer and fall and spring semesters. Pages assist representatives and senators in many ways, from delivering correspondence and taking messages to carrying bills and amendments to the desk when Congress is in session. Pages who serve during the school year keep up with their studies by attending Page School each morning before sessions begin. To apply, contact your senator or representative. Keep in mind that not every member sponsors a page; priority goes to senior members.

Similar but shorter (one week to one month) programs are available in many state legislatures. Contact your state delegate to inquire.

Project Vote Smart
Project Vote Smart is committed to providing voters with unbiased, relevant information on all elected officials. At their headquarters in Montana, interns and volunteers of all ages contribute to their mission by helping in every area, from answering the Hotline phones and creating press releases to helping with maintenance. PVS promises to provide interns with "in-the-trenches, hard, often monotonous work—and lots of it" as they contribute to this important cause. Internships last for an average of 10 weeks. *(406) 859-8683 or www.vote-smart.org*

United Nations Association of the U.S.A.
High school students may apply for fall, spring, or summer internships in Media Relations & Public Affairs or Education & Model U.N. Offices are located in Washington, DC. Application form is available on the Web site. *(202) 462-3446 or www.unausa.org/about_unausa/internships.htm*

STUDENT ORGANIZATIONS

Global Youth Connect
Supports youth-led projects that encourage activism for human rights and dignity. *www.globalyouthconnect.org*

National Association of Student Councils
Holds a national conference for student leaders; National Board includes student officers representing eight U.S. regions. *http://dsa.principals.org/nasc/*

Teenage Republicans
National organization that unites young Republicans through its high school chapters and annual convention. *www.teenagerepublicans.org*

Young Democrats of America
Supports the Democratic Party in all levels of government and works to involve youth in politics; high school chapters serve as branches of YDA county chapters. *www.yda.org*

Young Politicians of America
Organization with junior high, high school, and college chapters dedicated to community service and raising political awareness. *www.ypa.org*

Youth Action Net
Organization that brings together youth leaders to protect the environment, stand up for human rights, and support democracy. *www.youthactionnet.org*

Youth in Action
Provides programs, recognition, and incentives for youth-initiated activities that are improving communities and our nation. *www.youthlink.org*

PROFESSIONAL ORGANIZATIONS

American Bar Association
www.abanet.org

American Political Science Association
www.aspanet.org

American Trial Lawyers Association
www.atla.org

National Bar Association
www.nationalbar.org

National Association of Legal Assistants
www.nala.org

WEB SITES

AllPolitics
CNN's channel for keeping current with politics across the country.
www.cnn.com/ALLPOLITICS/

Capitol Spotlight
Weekly newsmagazine with links for following the political action in Washington, DC.
www.c-span.org/capitolspotlight/

Dialogue on Freedom
Read about this new civics education program that might be making its way into your classroom.
www.abanet.org/dialogue

FindLaw
Legal portal with links to legal news, information for students, laws in your state, and more.
www.findlaw.com

FirstGov
Official U.S. government portal with links to anything you could want to know about local, state, or federal government.
www.firstgov.com

Project Vote Smart
Expansive Web site that tracks elected officials' voting records, campaign finances, position statements, backgrounds, and more.
www.vote-smart.org

Rock the Vote
Organization founded by recording artists to empower young people and to protect freedom of speech.
www.rockthevote.org

Thomas: Legislative Information on the Internet
Find legislation, congressional records, committee information and more on this site provided by the Library of Congress.
http://thomas.loc.gov

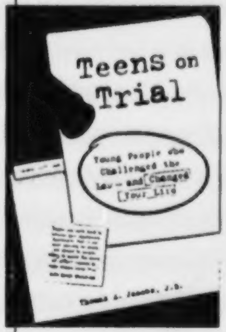
BOOKS

A HANDBOOK FOR STUDENT ACTIVISTS IN THE 21ST CENTURY

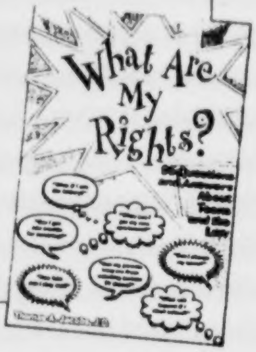
The Future is Ours: A Handbook for Student Activists in the 21st Century by John Bartlett (Owlet, 1996).

Make Yourself Heard
Teen Power Politics

Teen Power Politics: Make Yourself Heard by Sara Jane Boyers (Millbrook Press, 2000).



Teens on Trial: Young People Who Challenged the Law—and Changed Your Life by Thomas A. Jacobs (Free Spirit Publishing Inc., 2000).



What Are My Rights? 95 Questions and Answers about Teens and the Law by Thomas A. Jacobs (Free Spirit Publishing Inc., 1997).

The Supreme Court
You guessed it: all about the Supreme Court, from court rules and schedules to opinions and vistors' information.
www.supremecourtus.gov

The White House
News, policy summaries, speeches, as well as pages for the President, Vice President, and First Lady.
www.whitehouse.gov

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Adventures in Creativity:

Odyssey of

by Luke Murphy

My family has been involved with Odyssey of the Mind for nearly a decade. Both of my parents have coached multiple teams. My older brother competed for nine years and even wrote his college admissions essay about Odyssey of the Mind. My sister, who is participating for her eighth year, traveled to World Finals two years ago, where her team competed against teams from all over the United States and from countries like Germany, Canada, Hong Kong, and Singapore.

With a family history like that, I couldn't help but be interested. But it's the challenge of the problems and the excitement of competition that keep me coming back.

Choose Your Challenge

One of the best things about Odyssey of the Mind is that it is not just a one-day event. The season starts with the announcement in the fall of five Long-Term Problems, which fall into the same general categories each year. Teams choose one problem that they will work on for weeks or months. Then, at competition, they perform a skit that presents their solution.

The five categories give teams plenty of freedom; they can focus on the artistic or the technical. For the **vehicle problem**, teams build one big vehicle that will carry a person, or multiple smaller vehicles that complete tasks. For the **classics problem**, teams base a skit on a historical work of art, a piece of literature, tales, or even a myth. **Structure problems** require teams to build a structure out of balsa wood; the team that builds the lightest structure that holds up the most weight wins. The **environmental problem** challenges teams to create a performance in which they confront and then solve an environmental problem. Finally, the **technical problem** requires teams to make some sort of gadget, or multiple gadgets, that complete tasks. For instance, a team might have to design different booby traps to catch a burglar.

Luke and his teammate Jesse work together on a papier-mâché Sphinx.

Problem-Solving with Style

For the last three years, the teams I've worked with have chosen vehicle problems, which just seemed like the most fun. My favorite was from two years ago, which required us to build an Elasti-Pumper, a vehicle powered by elastic and an up-and-down pumping motion.

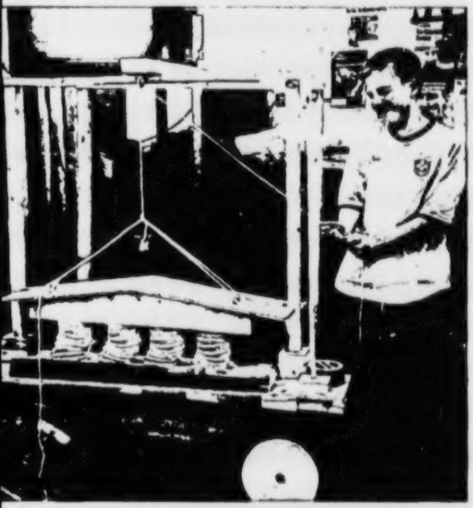
We spent about a month just brainstorming. Every part of our final solution—from the design of our vehicle to scenery to costumes—has to come from the team members, and not from anyone else, including our coach, our parents, or our friends. Teams are penalized, and sometimes disqualified, if they are helped by someone else.

Our team was made up of students with diverse skills. I built most of the vehicle with help from my teammate Deirdre. Alex made

the Mind

a trailer, which the vehicle had to pull. Kelly designed a lot of the scenery, and Lauren, a talented artist, painted most of it. Brenna and Caitlin worked mainly on costumes and writing the skit. In the end, we each felt that we'd made a significant contribution to the solution.

Every problem has a cost limit (usually around $100), and we have to fill out a form listing the costs of everything involved in the solution, including props and costumes for our presentation. My team and I built our vehicle using bungee cords, a coffee can, threaded rods, bike gears, a bike chain, PVC pipe, wheels, and plywood. At competition, our vehicle traveled around a course while I rode on it, pumping a handle up and down.



This year Luke's team is building a vehicle that turns into the Parthenon, the Sphinx, and the Great Wall of China. Here, Luke's teammate Jesse shows the transformation into the Parthenon.

For the Style segment of the competition, where we had to present our solution, we performed a skit that showed the capabilities of our vehicle. For example, we used the vehicle to change the appearance of a piece of scenery without touching it ourselves.

But even when we'd completed the Style segment successfully, there were still challenges ahead.

Creative Improvisation

While the Long-Term Problem and Style segments give us a chance to show off our months worth of work, the Spontaneous segment allows us to show how well we can think on our feet.

In Spontaneous, judges give a team a verbal, hands-on, or combined hands-on/verbal problem to solve creatively in a few short minutes. The faster you can answer, and the more creative your answers are, the more points you'll earn. One year, my team's verbal problem was to name different ways we could get out of eating lima beans for dinner. We had one minute to think of responses, and then two minutes to respond. Every common answer, such as saying you weren't hungry, was worth one point. Every creative answer, like asking to put the lima beans in the microwave, but then putting them in for too long so they would blow up, was worth 5 points.

For hands-on problems, teams have to build something or draw something instead of giving verbal answers. But the best problems are hands-on/verbal problems. One year, my team had a problem in which the first person began a story, then drew a picture. The second person then continued the story with another sentence, based on the first person's picture. This continued until the story was finished. Problems like these help make Odyssey of the Mind not just challenging, but fun.

P.S.: In Case You Were Wondering...

At regionals, the seven of us huddled together in the bleachers at the State University of New York at Oneonta, holding hands with our eyes closed as we waited for the announcement of the first-place winners for the vehicle problem. I opened my eyes just enough to see the trophy shining on the table next to the podium and wondered if we'd be holding it moments later. "And now, first place for Division II Elasti-Pumper goes to … Sherburne-Earlville!" The audience erupted in applause and cheers as the seven of us walked down the aisle to receive our trophy and medals. By winning first place at regionals, we had finally qualified for the state competition.

We didn't win at states, but just making it that far was an accomplishment. This year, my team is working especially hard, hoping to make it not just to states, but to the ultimate goal of all Odyssey of the Mind teams: World Finals! ■

Luke Murphy is an eighth-grader at Sherburne-Earlville Middle School in Sherburne, NY. Luke has acted in high school and community theater productions, and also plays trombone in the jazz band. He is now in his sixth year of participating in *Odyssey of the Mind*.

Odyssey of the Mind **offers four age divisions for students in kindergarten through college. Teams compete in annual competitions at the local, state, and national level. To get involved, find your local coordinator at www.odysseyofthemind.org or call (856) 456-7776.**

Quirky Cows & Computing Challenges

The USACO

Identical twins Gary and Steven Sivek have been participating in the USA Computing Olympiad (USACO) for three years. Both have qualified twice for the summer training camp; last year, as a member of the U.S. team that competed at the International Olympiad in Informatics in Tampere, Finland, Steven earned a bronze medal.

In this article, Gary and Steven explain why this contest keeps them coming back—and why other teen programmers should join them.

by Gary and Steven Sivek

Bessie the Cow wants to use a pogo stick to travel along a cow path of integer length, L. Bessie starts at point 0 and proceeds in integer pogo-jumps to land exactly on point L. Bessie's velocity, V, starts out at zero and is always nonnegative. At the beginning of each bounce, she can change her velocity by -1, 0, or +1. The velocity is the distance Bessie travels along the path during the bounce. Bessie can be traveling at any nonnegative velocity when she lands on point L. Bessie wishes to avoid jumping on any of the cow pies that happen to be located at various integer points along the path (not including location 1 or location L, of course). Your job is to determine the smallest number of bounces to reach exactly the end of the path, point L.

Thus begins a problem entitled "Cows on Pogo Sticks" from the USA Computing Olympiad's 2000 Fall Open. Accompanied by three other programming tasks, this formed part of a five-hour contest designed to challenge the best high school programmers from around the world. This is typical of the contests conducted since USACO's inception in 1993: problems differing in difficulty and solution methods, a wide range of scores among participants, and, of course, bizarre bovine humor.

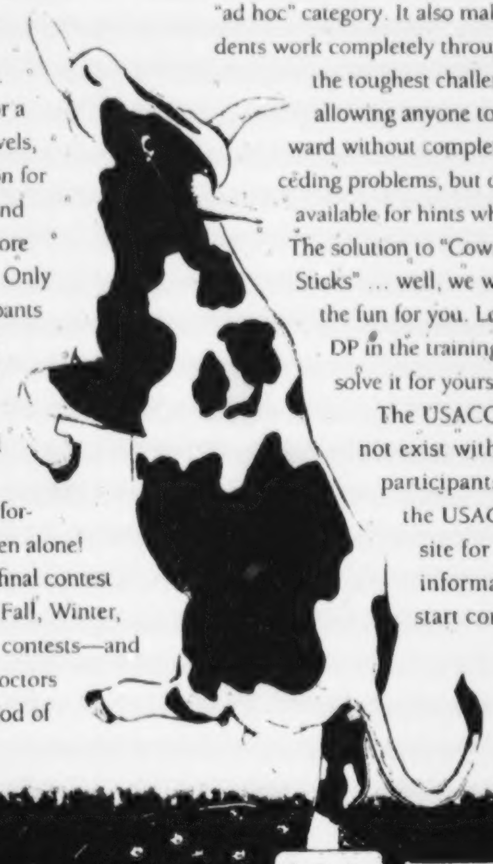
These USACO contests simply wouldn't be the same without cows. These animals, abundant in the olympiad's home state of Wisconsin, the site of its annual training camp, are featured in nearly every problem as they engage anthropomorphically in a number of activities: attending "kinergarten," planning an L-shaped pool for their forest, and jogging around their pasture, among other things. Sometimes the benevolent Farmer John plays a pivotal role in the problems: trying to give cows gifts according to their wish lists, dividing the herd into a set of fields, or just calling the cows home for dinner. If you understood the "kinergarten" pun—*kine* is an archaic plural of *cow*—you'll love the bovine touch that helps USACO stand out among the science olympiads!

These contests have another purpose beyond simple Holstein hijinks and Guernsey glorification, of course. Each year, they ultimately determine the top 15 programmers (using C, C++, or Pascal) in the United States, who win a trip to the University of Wisconsin–Parkside as finalists. There, after a week of intense training and contests, the four-person team is selected that will represent the U.S. in the annual International Olympiad in Informatics (IOI). The U.S. team has historically excelled in competition. Last year's team of Reid Barton, 18; Tom Widland, 18; Vladimir Novakovski, 16; and Steven Sivek, 17, won the top gold medal, two silver medals, and a bronze medal, respectively.

Programmers in Training

The 2001 training camp was a nonstop flurry of activity for the finalists, selected after an unusually grueling U.S. Open in which only one competitor received even half of the points possible. After arrival and introductions on the first day, every day began with either one of four three-hour experimental contests or one of two exhausting five-hour "Challenge Rounds," used to determine the team of four. Afternoons included discussions of solutions from the morning's contest, planning for the next day's contest strategy, lectures in different techniques, and, of course, time for relaxation activities such as Ultimate Frisbee, Disc Golf, an annual business simulation game, and various excursions to movies, museums, and water parks. Nights included presentations by the coaches on hot research topics in computer science such as operating systems, network security, and mapping the Internet, which all showed interesting applications of computer science outside of these contests.

The 2001-2002 season has had a strong start, drawing almost 500 competitors in recent contests. Two divisions allow for a wider range of skill levels, with an orange division for those just beginning and a green division for more experienced students. Only green division participants are considered for the training camp, but students can switch to green mid-year and even earn an invitation from a strong performance in the U.S. Open alone! The U.S. Open is the final contest of the year—after the Fall, Winter, February, and Spring contests—and is administered by proctors in schools over a period of five hours.



The Help Page

Of course, it's easier to be interested in these contests than it is to excel in them. If you were confused by the sample problem, you're not alone. But there is something you can do about that! Since the Winter 2000 contest, the coaches and some top-performing students have worked to provide an interactive training site online (http://ace.delos.com/usacogate) where you can try your hand at these problems and learn techniques to solve them.

The page provides resources on such topics as the ever-popular dynamic programming (affectionately called "DP"), shortest path algorithms, greedy algorithms, network flow, effective search techniques, minimal spanning trees, computational geometry, and any other problem type that contestants might encounter, including the mysterious "ad hoc" category. It also makes students work completely through even the toughest challenges, not allowing anyone to move forward without completing preceding problems, but coaches are available for hints when needed. The solution to "Cows on Pogo Sticks" ... well, we won't spoil the fun for you. Learn about DP in the training pages and solve it for yourself!

The USACO would not exist without its participants. So, visit the USACO Web site for more information, and start competing! ■

Program Your Way to the IOI!

The USACO offers four Internet contests (November, January, February, and March) in which individual precollege students have three to five hours to solve three to five problems. Students are encouraged to, but do not have to, participate in all of these contests before entering the U.S. Open. The U.S. Open will be given on April 11, 2002, at local high schools.

Based on their performance in any contests they complete as well as their work on training materials, 15 students are selected for the USACO Training Camp. Four students from the training camp will form the U.S. team that will travel to the International Olympiad in Informatics in August, to be held this year in Korea.

Visit www.usaco.org for more information, including past problems and instructions for joining the mailing list.

Gary Sivek is a senior at Thomas Jefferson High School for Science and Technology in Alexandria, VA. He is a dedicated member of the Varsity Math Team, the *It's Academic* team, and, of course, the Senior Computer Team at TJ, where he also runs the school's Intranet as a system administrator. He hopes to double major in math and computer science in college.

Steven Sivek is also a senior at TJHSST. When he's not solving USACO problems, he is captain of the computer team, math team statistician, one of a team of Linux system administrators, and a member of the *It's Academic* and Science Bowl teams. He is planning to study math and computer science in college.

Off The Shelf

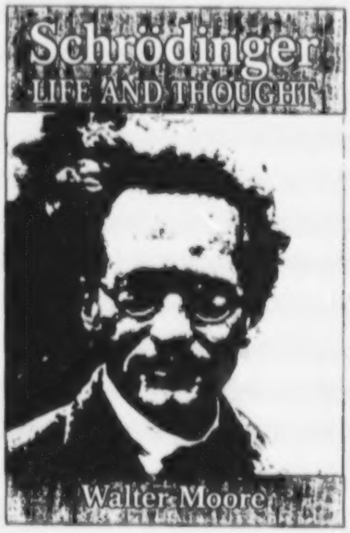
Schrödinger: Life and Thought

Review by Partha Raina

A few years ago, I heard a former President of the Indian National Science Academy, himself a distinguished physicist, admire Erwin Schrödinger and mention how Indian metaphysics had captivated him. Recently, I came across some references mentioning his philosophical inclinations, which again aroused my curiosity. Then, fortunately, I found Walter Moore's biography of Schrödinger. Drawing upon recollections of Schrödinger's friends, family, and contemporary colleagues, as well as records, correspondence, and personal diaries, this biography weaves together details from Schrödinger's scientific and personal life to create a fascinating portrait of a complex person.

Like most good biographies, Moore's book offers details about Schrödinger's childhood that seemed to have great influence on his later life. His father, a businessman, earned a degree in chemistry and also had gifts in painting and botany. Schrödinger seemed to inherit similarly diverse interests—in school he loved not only the sciences, but also poetry and classical literature and grammar. Throughout his life he pursued eclectic interests both in and out of science, interests that would feed each other in fascinating ways.

Schrödinger is perhaps most famous for his work on wave mechanics, for which he shared the 1933 Nobel Prize with Paul Dirac. Moore not only highlights such scientific achievements, but also presents careful descriptions of Schrödinger's work and places it in a larger context. Schrödinger's invention of wave mechanics, for example, is contextualized with his correspondence from that time. Considered elegantly intuitive, Schrödinger's work on wave mechanics was greeted with enthusiasm by the physics community: Planck described it as "epoch-making work," and Einstein wrote to him that "the idea of your work springs from true genius." Interestingly, Moore points out, Schrödinger did not consider this work a great achievement, as he did this work at the age of 38, while other scientists had done great works at a younger age.



Linus Pauling, who at one point wanted to work under Schrödinger's supervision, considered him the idea man of science. And for good reason. As Moore illustrates, Schrödinger had interests in and made important progress in many areas of physics. His work encompassed color theory, the statistical nature of radioactive decay, the kinetic theory of solids, physiological optics, electromagnetic theory, quantum theory ... the list goes on and on, even beyond physics. His book *What is Life?* (1944) introduced a concept that became a cornerstone of molecular biology: the function of chromosomes as a "code script" determining the characteristics of the organism to which it belongs.

On a timeline, the events and achievements in Schrödinger's life would look crowded—and chaotic. For example, he held academic posts at eight universities in Austria, Germany, England, and Ireland. But Moore does an excellent job of connecting the events to reveal not only Schrödinger the scientist, but Schrödinger the man.

I was surprised to learn of Schrödinger's political naiveté; by his own claim, he was a "man without politics." However, one gets to see how a lack of professional politics was sometimes harmful to him: his handling of the publicity surrounding his work on a unified field theory, about which he had corresponded with Einstein, ultimately lost him Einstein's respect and friendship. Reading the details is fascinating indeed. In addition, Moore chronicles Schrödinger's various love affairs—including those with his friends' wives. This is an essential part of the story; Schrödinger himself wrote in his autobiography that "leaving out relations with women in my case creates—a great void," indicating that his love affairs were related to his creative activity in sciences.

I also enjoyed Moore's treatment of the Hindu influence on Schrödinger's work, the subject that had first attracted me to the biography. Schrödinger read widely from Hindu texts, and what he read informed and shaped his work in science. Moore explains how these philosophical ideas manifested in *What is Life?* and even in Schrödinger's work on wave mechanics. According to Moore, "unity and continuity of Vedanta are reflected in the unity and continuity of wave mechanics." I found this discussion particularly satisfying.

In summary, Moore's lively and comprehensive scientific biography presents a unique story, one that explains the characteristics and circumstances that made Schrödinger an extraordinary physicist. If you're intrigued, like I am, by complex personalities, you'll love this book. ■

A ninth-grader at Emerson Junior High in Davis, CA, *Partha Raina* is an avid reader of biographies of extraordinary people. Partha received the California Association of the Gifted's 2002 Student Grant to make a detailed case study of Arnold J. Toynbee. He is interested in biology and math and looks forward to doing research in biotechnology.

Word Wise
Political Wit and Wisdom

by Carol Blackburn

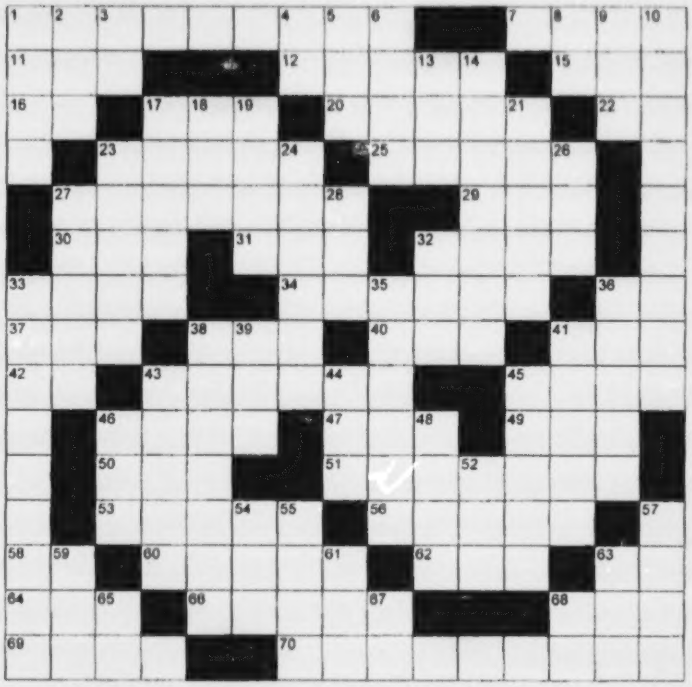
Note: For clues that are quotations, the answer is the person who wrote or said it.

ACROSS

1 "Too bad ninety percent of the politicians give the other ten percent a bad reputation."
7 "A government that robs Peter to pay Paul can always depend upon the support of Paul."
11 "Any man who wants to be president is either an egomaniac or crazy."
12 "The penalty that good men pay for not being interested in politics is to be governed by men worse than themselves."
15 Unratified amendment
16 Jesse Helms's home state
17 Mr. King Cole
20 Cheat
22 Butte locale (abbr.)
23 "What did the president know and when did he know it?"
25 More
27 "Democracy is the theory that the common people know what they want, and deserve to get it good and hard."
29 Dispose of
30 And so forth
31 __ Clemente
32 Cover up
33 Metropolis
34 41 or 43, or 1
36 South America (abbr.)
37 Attention getter
38 Body, in police lingo
40 Opponent
41 Socks or Millie
42 Primeval (Ger.)
43 33 Down, affectionately
45 George W. Bush's advisor
46 Father
47 Beer
49 Bullfight cheer
50 Publicity
51 "If I were two-faced, would I wear this one?"
53 Hieronymus ______
56 Father and son presidents
58 Kind of crowd
60 Couches
62 Mess
63 Kind of conspirators
64 "Great Society" president
66 Lymph _____
68 "You can't set a fox to watching the chickens just because he has a lot of experience in the __ house." - Harry Truman
69 "To retain respect for sausages and __, one must not watch them in the making." - Otto von Bismarck
70 "We in America do not have government by the majority. We have government by the majority who participate."

DOWN

1 "...the greatest tragedy of this period of social transition was not the strident clamor of the bad people, but the appalling silence of the good people."
2 Imperial Klingon Cruiser (abbr.)
3 Southeast (abbr.)
4 Family doc
5 Imp
6 Uncommon
8 Pronoun
9 Build up
10 Famously described as "a cancer on the presidency"
13 Death __
14 Scandal
17 Mrs. Reagan
18 American Kennel Club (abbr.)
19 Tex homonym
21 Impel
23 Mrs. Ford
24 "I am not worried about the deficit. It is big enough to take care of itself."
26 Lemon__
27 Civilization creator Sid
28 Compass point
32 Not an amateur
33 "The best argument against democracy is a five-minute conversation with the average voter."
35 GWB's pet cow
36 Lucky number
38 "A billion here and a billion there, and pretty soon you're talking about real money."
39 Singular
41 Surveys
43 Alcoholics
44 ALGOL's precursor
45 Spacious
46 Brother or sister
48 Means' justification
52 India Bush
54 CEO's colleague
55 Pilgimage to Mecca
57 GWB's birthplace
59 Athletic assn.
61 View
63 Business exec.
65 Jehovah's Witness (abbr.)
67 Sci fi (abbr.)
68 Grades 9-12



Solution on page 34

EXPLORING CAREER OPTIONS

Information Security

Interview with

Dorothy Denning, Ph.D.

by Carol Blackburn

An expert on information security and cyber crime, Dorothy Denning is a Professor of Computer Science at Georgetown University. Since 9/11, her expertise on cyber crime and cyber terrorism have kept her busy advising policy makers and government officials. A past president of the International Association for Cryptologic Research, she was named TechnoSecurity Professional of the Year in 2001 and was also honored by *Time* magazine as a security innovator.

Give us a sense of the need for information security.

We all enjoy the advantages of the global society made possible by the Internet and other forms of connectivity, but that connectivity has a flip side: those same connections enable people to pursue destructive and often illegal activities. Cyberspace is constantly under assault. Thrill-seekers, thieves, spies, and saboteurs launch computer viruses and worms, disrupt service, vandalize Web sites, harass people and companies, hack into computer systems, steal information, and conduct fraudulent transactions. Many of the attacks are serious and costly. The ILOVEYOU virus was estimated to have hit tens of millions of users and cost billions of dollars in damage. The need for information security is enormous.

What does "information security" encompass?

It involves protecting information from threats that fall into three basic categories. One is confidentiality: trying to prevent unauthorized access to sensitive information, from credit card numbers to medical records to government files. A second is integrity: trying to protect against unauthorized modification of information. Threats of this sort include computer viruses that corrupt or destroy files, data tampering, data sabotage, and Web site vandalism.

The third category is availability: ensuring access to information. This is a very broad category, ranging from threats like computer viruses that might cause you to shut down operations to overt denial-of-service attacks, which typically involve flooding servers with massive amounts of traffic, to physical threats. One of the most important areas of security is what's called *continuity planning*: making sure that if some event happens—whether it's caused by a malicious act or an accident or a natural disaster—your information infrastructure is still available. We saw the importance of this kind of planning with the World Trade Center attack, when businesses in the WTC had to rely on their backup systems outside New York City.

How did you get interested in this field? Were you interested in codes and ciphers as a kid?

Not at all. And I never touched a computer until I went to college. There were no PCs when I was growing up. I went to college to study to be a math teacher. But from the first time I tried programming, I loved it, and I decided to do graduate work in computer science. For one of my first classes in graduate school, I did a project on information security. From the start, it just grabbed me as interesting and challenging.

What kinds of problems have you worked on?

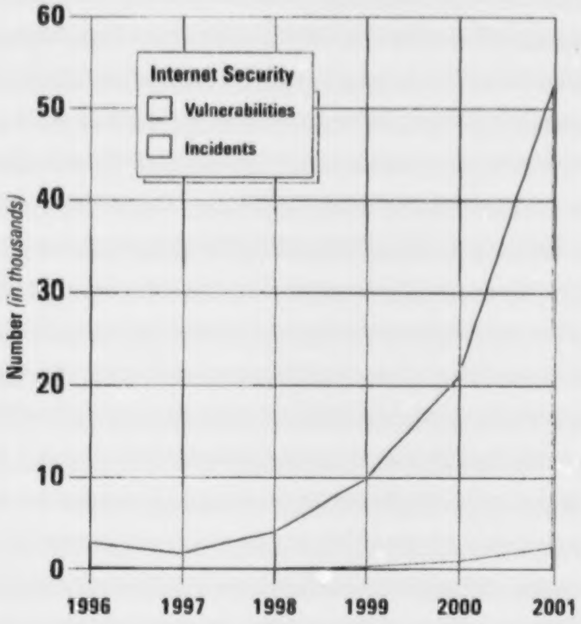
My most enduring interest has been cryptography, a field that was largely confined to government agencies until the 1970s. Then, businesses began to need data encryption methods, and researchers outside the government began studying the technology and inventing new methods of encryption. I started working in the field soon after a group of academics invented public-key cryptography, which revolutionized the field. The field has evolved very quickly, legally as well as technically. I've been involved in both basic research and the public policy debate about government encryption policy.

Today, most of my work is at a more conceptual level; rather than focusing on specific security problems, I try to stay abreast of the whole computer security field and understand general threats such as cyber terrorism. But I'm still doing some encryption research. At present, encrypted information can be decrypted anywhere in the world as long as someone has the key to decrypt it. I'm working on a technology I call "geo-encryption," which will protect a message so that it can only be decrypted at a particular location in the world, say, at a given embassy or corporate office. This can be done using location data from a GPS satellite. We're testing a demo right now.

In the 1980s, I developed a model for a real-time intrusion-detection system. The basic idea is to monitor the standard operations of a system and look for deviations in usage patterns. An abnormally high rate of password failures, or an authorized user logging on at a different time or location than usual, might indicate an intrusion or misuse by an insider. The model is at the core of some existing intrusion-detection systems today.

Why did you move from basic research to broader policy issues?

At some point, I really felt a need to understand the broader contextual issues of my work. I had been completely focused on the security side of the problem, looking for system vulnerabilities and ways to protect against them, without ever having really studied the threat. I hadn't studied hackers, nor had I spent time with the law enforcement professionals who must try to catch people who abuse computer systems. I needed to spend some time looking at those issues, so I did. For months, I studied the hacker community as though I were an anthropologist.



The problem is growing. Carnegie Mellon University's Computer Emergency Response Team (CERT) monitors Internet ***security vulnerabilities*** and ***reported incidents***. An incident can involve thousands of victims; for example, the ILOVEYOU virus was a single incident. (Source: www.cert.org/stats/cert_stats.html)

And what did you discover?

I realized that some of the threats we academics were spending our time on were really fairly esoteric things. The actual threats were a lot more mundane, but nonetheless serious. Once I saw that, I couldn't go back; I wanted to stay involved with the real world, and I have ever since. Taking a faculty position in Washington, DC, facilitated being involved in governmental hearings and committees on information security. Now I'm more of a generalist and adviser.

I also found it very satisfying to be involved in the public debate about the issues my work raised: questions about privacy, government intrusion, and law enforcement. Encryption protects law-abiding citizens who shop online, but it also helps criminals hide their activities. There are a lot of very challenging legal and ethical issues in this work, and I don't find easy answers to them. They need to be examined and debated.

The rapidity of the change of both hardware and software must make your work very challenging.

Because software is getting more complex, and because new products are coming out all the time, there is a never-ending supply of vulnerabilities that, once discovered, are quickly exploited. New vulnerabilities appear every day. There are also hundreds of sites where someone can now download sophisticated hacking tools that allow even those with modest skills to launch devastating attacks. So there are more attacks. The numbers are all going in the wrong direction.

It's a hard fight—harder in some respects than physical security. On the Internet, street gangs have the whole world at their disposal, and they can wreak havoc from anywhere in the world. And it's very hard to find them.

September 11th has made everyone more concerned about security. To what extent is cyberspace vulnerable to terrorist activities?

Politically motivated hackers or "hacktivists" are already quite active in relatively benign ways. Web defacements and denial-of-service attacks are the most common forms of attack. But most activists, whether they participate in a street march or a cyber event, are not terrorists. This is an important distinction.

While cyber attacks have caused billions of dollars in damage and affected the lives of millions, few if any can be characterized as acts of terrorism. Fraud, theft, sabotage, vandalism, yes; but terrorism, no. Their effects, while serious, pale in comparison to the horror we witnessed on 9/11.

However, since at least some hackers sympathetic to terrorist organizations are engaging in cyber protests, will they or terrorists specifically trained in cyber methods conduct future operations using cyberspace? Will they target critical systems, like power or water supplies? Or will they use cyber attacks as an ancillary tool to amplify the impact of a physical attack, for example, by jamming 911 emergency services or shutting down electricity or telecommunications after blowing up a building or releasing toxic gases? We know that critical infrastructures are potentially vulnerable to a cyber terrorist attack because hackers have already compromised 911 services, air traffic control systems, and other vital systems. Such systems are very complex, making it impossible to eliminate all weaknesses.

Even if systems are made more secure, insiders can exploit their access to wreak considerable harm. Consultants and contractors are also in a position to cause harm, as an alarming incident in Japan showed. In 2000, Japan's Metropolitan Police Department discovered that a software system they had commissioned to track police vehicles, including unmarked cars, had been developed by members of the Aum Shinryko cult, the group that gassed the Tokyo subway in 1995. Investigations showed that cult members had also helped develop software for at least 80 Japanese firms and 10 other government agencies. They had worked as subcontractors to large firms, making it harder to detect the security risk they posed. They could easily have installed Trojan horses to launch or facilitate cyber attacks at a later date.

Wow! That's scary.

It is. Studies have shown that the vast majority of hackers are disinclined towards violence. It's also not in their interest to cause a major disruption of the Internet. But it would take only a few willing hackers to turn cyber terrorism into reality. Furthermore, the next generation of terrorists will grow up in a digital world, with ever more powerful and easy-to-use hacking tools at their disposal. They might see greater potential for cyber terrorism than do the terrorists of today, and their level of knowledge and skill relating to hacking will be greater. Cyber terrorism could also become more attractive to terrorists as the real and virtual worlds become more closely coupled, with appliances connected to the Internet. Unless these systems are carefully secured, conducting an operation that physically harms someone may be as easy as penetrating a Web site is today.

How vulnerable is wireless, the latest addition to cyberspace?

Wireless is a big security problem. It's not just that *individuals* are making insecure calls and sending insecure messages; entire *companies* are operating corporate networks on wireless without any security. Hackers do what they call "war driving" or "drive-by hacking": they drive into an area where a network operates and then connect to it, allowing them to pick up traffic on the network. One group did a study in London. Driving around the city, they could get into two-thirds of the networks. The networks were wide open.

How good do your math or programming skills need to be to work in information security?

It depends on what you want to do. The most mathematically demanding jobs are in cryptography and certain aspects of intrusion detection. Computer science skills are also needed in order to develop security technologies and products. If you want to work on these kinds of problems, you can work for the government, in academia, or in the private sector, with companies that build security products. But there is also a great need for people who want to help businesses protect their systems using security products created by others; and to do that, your computer skills don't have to be that good, although you should have a good understanding of the technology. Nor do you need to program if you want to work at higher levels of abstraction, on problems such as contingency planning, or with the legal or policy aspects, such as privacy issues. So there are a lot of options.

Is there anything we haven't touched on that you'd like to mention?

Another fascinating area is computer forensics, which includes finding the evidence of crimes on computers. Getting information out of a computer—finding it, recognizing it, and recovering it without contaminating it—can be very challenging, especially if the information is encrypted. We need computer forensics specialists not only in law enforcement agencies but also in business; if a security breach occurs within a company, they may need to find out what happened on their own computers, especially if it was done by an insider. We're seeing this now as investigators try to recover files destroyed by Enron and Arthur Andersen employees. There are many kinds of challenging, important, rewarding work to be done in information security.

To learn more about information security, see www.cs.georgetown.edu/~denning/ or www.cty.jhu.edu/imagine/links_94.htm

Planning Ahead for College

College-Level Courses for High School Students

by Linda E. Brody, Ed.D.

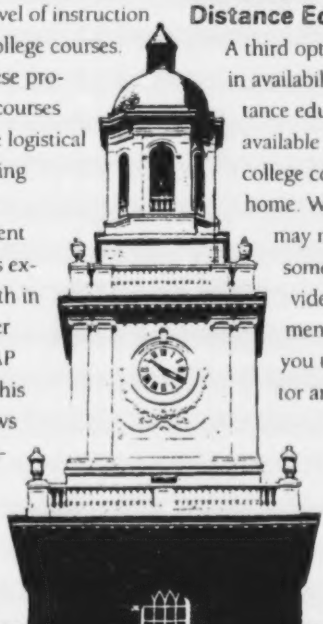
Many of today's college freshmen enroll with a considerable number of college-level courses behind them. As more middle- and high-school students accelerate the pace of their learning through summer programs and distance education, many are completing the typical high school program before they are ready to enter college full-time.

The 10th grader who is taking Calculus or Physics, or the 11th grader in 12th grade English needs to follow these courses with what comes next: college-level math, physics, or English, respectively. Fortunately, such advanced courses are very accessible to high school students who are ready for college-level courses but not ready to graduate from high school. But which is the best option for you? And will you get credit or advanced placement for these courses when you go to college full-time?

Courses at Your High School

Many high schools offer college-level work through the Advanced Placement (AP) and International Baccalaureate (IB) programs. Their curricula offer teachers guidance in providing a level of instruction comparable to first-year college courses. Students who enroll in these programs can take advanced courses with age peers without the logistical issues and expense of finding courses outside of school.

The Advanced Placement program, in particular, has experienced incredible growth in recent years. Last year, over 1,000,000 students took AP tests in 32 subject areas. This very flexible program allows students to advance in specific subjects; for example, a student might be ready for AP Calculus but not AP French. The IB program, on the other hand, is typically offered as a block, with students working toward a diploma that is intended to be equivalent to a full year of college-level work.



Courses on a College Campus

Students who desire advanced courses may also turn to offerings on college campuses in the summer or during the year to supplement high school courses. A vast number of colleges, eager to show their campuses to prospective students, have opened their doors to advanced high school students.

In recognition of high school students' need for more options, an increasing number of states have passed Dual Enrollment legislation. Depending on the state, these laws allow students to enroll in a local college, often tuition free, and simultaneously earn high school and college credit for the courses.

Bringing Courses to You: Distance Education

A third option that is increasing rapidly in availability and popularity is distance education. Full catalogs are available from some universities with college courses you can complete at home. While working home alone may not appeal to all students, some online courses now provide virtual classroom environments with opportunities for you to interact with your instructor and classmates.

Obtaining Credit or Placement

Colleges differ on their policies with regard to awarding credit for college-level coursework taken by high school students. Investigate the particular policies of the colleges to which you are applying.

Typically, if you apply as a freshman to a selective college or university, you will find them more willing to award credit for AP and IB courses than for courses taken through a college because the curriculum and examinations are standardized. If they do grant credit for a course taken through a college, it is more likely to be for a standard course that everyone offers, such as Survey of Art History, than for something unique such as Women and Politics. If possible, consider taking the AP exam for any courses you complete through a college to enhance the likelihood of obtaining credit.

You are more likely to keep all of your college credits if you enroll full-time at the college where you earned them or if you apply to college as a transfer student, but that will limit your college choices. If you plan to stay in college for four years anyway, credit may not matter at all; but advanced placement—the opportunity to take courses at a level you have not yet mastered—is important. Most colleges have flexible policies with regard to placement.

If you don't obtain credit, is college-level work a good idea? Absolutely! The most important thing is to keep learning. You don't want a gap in math skills, for example, from taking no math your junior and senior years of high school because you ran out of courses. The rigor of college-level work will help you develop the discipline and study skills you will need in college, and admissions officers will be pleased to see that you have succeeded in college-level coursework.

For a listing of distance learning and summer program options, check out the links on *Imagine*'s Web site: www.jhu.edu/gifted/imagine

CLAREMONT McKENNA COLLEGE

The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 20 students, who major(ed) in Chicano studies (1), economics (6), government (8), history (2), international relations (1), management engineering (1), math (1), philosophy (1), politics, philosophy, & economics (PPE) (4), psychology (3), Russian (1), and Spanish (1). (The number of majors exceeds 20 because several students had double majors.) Reviewers' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Claremont McKenna College (CMC) is one of the Claremont Colleges, a unique consortium of five autonomous undergraduate institutions on adjacent campuses. Each college has a different focus; CMC's is on educating students for leadership positions in government, business, and law. Students at each of the Claremont Colleges may take courses at the other colleges, providing opportunities usually found only at large universities. Reviewers were unanimous in praising the education they received at CMC.

➤ "Outstanding. The small classes and intimate relationships with professors were remarkable. Even introductory survey courses were taught by accomplished, experienced professors and rarely contained more than 30-40 students. After graduating from CMC, I attended Harvard Law School, where I met people from a wide variety of other top schools, both small and large. I found few people who seemed to have had an academic experience of the same depth and intimacy as I did. More than anything, it is the personal nature of the CMC education that distinguishes it."

➤ "CMC's quality of instruction is nothing short of amazing. If I were to create an ideal paradigm for how professors and students should interact in the college environment, it would not be much different from CMC. First and foremost, the school fosters an intellectually intimate environment. This is a place where professors truly care about student learning. Professors not only encourage students to visit them, but even schedule compulsory office hours. A thesis is required for graduation, ensuring that each student forms a close working relationship with at least one professor. CMC's small size means you never get lost in the shuffle. Classes are small, usually under 20 and never more than 40."

➤ "The school focuses on leadership, with economics, government, and psychology the most popular majors. Although academics are stressed, there is a demonstrable effort to provide a balance between theory and real-life applications of knowledge, which helps prepare students for whatever they choose to do after college. CMC does a very good job placing its students into some of the best companies and organizations in the world. Opportunities abound for jobs in consulting, investment banking, accounting, and government, just to name a few. CMC also has a fabulous reputation with top graduate schools and prestigious postgraduate scholarships."

➤ "One of CMC's greatest strengths is its multidisciplinary programs: PPE (Politics, Philosophy & Economics), EEP (Environment, Economics & Politics), and M-E (Management Engineering). PPE, modeled on the major of the same name at Oxford University, is simply amazing. It is limited to approximately 12 students per year and combines group discussion led by a professor with Oxford-style tutorials, where students meet individually with a senior professor to review their papers. CMC and PPE prepared me well for both work and graduate study at a top law school and a top business school."

➤ "I participated in M-E, a 3-2 program that includes three years of study at CMC, then two years at an engineering school. At the end of five years, I obtained a B.A. from CMC in Management Engineering and a B.S. from Stanford University in Industrial Engineering. The quality of instruction at CMC was excellent and in most respects better than the instruction I received at Stanford. As promised, the M-E program prepared me well for engineering project management responsibilities upon graduation."

➤ "In addition to the superb teaching, CMC offers programs that complement the classroom learning. One of the most popular is the Athenaeum, an unusual program in which guest speakers—from prominent scholars to government officials to journalists to entertainers—meet with students and faculty over a fine dinner provided by the school. Dinners at the Athenaeum help students develop real-world understanding, cultural awareness, and social graces."

➤ "CMC offers a unique opportunity to participate in government through its Washington Semester Program (WSP). A number of schools allow students to intern part-time with government agencies or nonprofit groups in Washington. WSP is special because it allows students to intern full-time while taking a few evening classes with CMC professors resident in Washington. The difference between part-time and full-time interning is everything: as a full-time intern, I was considered a regular employee and given real, substantive work to do, not the 'grunt' work the part-time interns did. The success of the WSP is evident in the number of CMC alums who choose to return to Washington after graduation."

Social Life

Reviewers all enjoyed the social environment.

➤ "Very active. With over 5,000 students across the five colleges, activities of every kind are available: theater, intramural sports, student-run media, outdoor activities. Five-college parties are abundant on weekends. CMC's social environment is very close knit, but is balanced by the opportunities provided by the five-college system."

➤ "Nearly everyone lives on campus all four years, which makes for a very lively and intimate campus atmosphere (think 'summer camp'). Dorm life is one of the best parts of CMC. While the student body is not overly diverse, the commonalities in the students' interests enriched the experience for me. And with such a small student body, I knew nearly everyone at CMC. I also made many friends with students at the other Claremont Colleges. In fact, I ended up marrying one!"

➤ "Both the campus and the town of Claremont are very safe. Many students rarely leave campus; but when they do, they have access to a huge number of museums, activities, and events in greater Los Angeles. Mountains, beaches, and deserts are also accessible within a short drive. And the climate is great—I went a month without wearing shoes!"

What Do You Like Best about CMC?

➤ "This is the ultimate college experience. You learn a lot, but you have fun at the same time. And when it comes time for professors to write you recommendations for graduate school, they can write honestly, rather than sending in a form letter. The students are excellent and supportive peers. And every other day, somebody important shows up for dinner at the Athenaeum. During my years there, I had dinner with heavyweights from all walks of life—Maya Angelou, Danny Glover, Steve Forbes, Milton Friedman, Henry Kissinger, just to name a few. I can't think of another 21-year-old who has had that sort of experience."

➤ "The intimacy. I felt part of a community in the true sense of the word. And the generosity of the college. The financial aid office works miracles to support students in need."

➤ "WSP was one of the best semesters of my life. It's amazing how well-connected CMC alumni are in Washington and how generously they give of their time to WSP students. After I graduated, I obtained a full-time job with the organization with which I interned. I don't think that would have happened had I not participated in WSP."

BAUER
CLAREMONT McKENNA

Claremont McKenna College

Claremont, CA 91711
(909) 621-8088

▽ 4-year private coed college.

▽ Campus in suburban Los Angeles.

▽ Semester system.

▽ Full-time undergraduate enrollment 2001-02: 558 men; 486 women.

▽ Special features: dual-degree programs: 3-2 BA/BS program with Stanford and 4-1 BA/MBA program with the Drucker School of Management.

What Do You Like Least about CMC?

➤ "The smog. The San Gabriel Mountains are beautiful—when you can see them!"

➤ "Non-Asian minorities are not well-represented."

➤ "CMC doesn't have the name recognition that Amherst or Swarthmore does. However, CMC's nationwide recognition is growing, and it is well-known in the academic community."

Who Would Be Most Compatible with the Academic and Social Atmosphere at CMC?

➤ "CMC is for students with initiative and direction, who want to be a big fish in a small pond. It's a place where students who want to take leadership roles in business and government can gain the skills and knowledge that will help them excel. Students are outgoing, ambitious, confident, and practical. People looking for meaty existential debates will probably be happier elsewhere."

➤ "Anyone who values community, connections, and an intimate learning environment, and who doesn't mind not having a major college sports team to follow as an alum."

If You Had It to Do over Again, Would You Go to CMC?

All but one reviewer enthusiastically said yes.

➤ "Heck, yes. I've had the privilege of studying at Harvard, and I can honestly say that I got a much better education—and had more fun—at CMC."

➤ "Without a doubt. I went to CMC for PPE and the five-college system and I was not disappointed. I believe that more people graduate from CMC saying 'I love my college' than from any other school in the country."

➤ "CMC is what Ivy League schools used to be—a tight-knit community of intellectuals, a harborer of top-notch faculty who care deeply about student learning, and a sculptor of the well-rounded individual. I would choose CMC a hundred times over without regret."

➤ "Yes. The only thing I would do differently would be to think more carefully about the implications of leaving CMC after my junior year. I certainly wouldn't want to give up my Stanford experience; but missing senior year at CMC is the downside of the M-E program."

➤ "No. I'd pick a school like CMC in size and teaching philosophy, but with a more ethnically diverse student body."

Note: The reviewers quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

Sound Off

For this issue, we asked the *Imagine* Readers Panel, *What role do you envision for teens in the Freedom Corps described by President Bush in the State of the Union Address?*

One of the most important services anybody can provide is aiding those in need, and often the only qualifications are the ability and desire to help out. I think teenagers are especially well suited to assisting other young people and the elderly. Serving at nursing homes or hospitals, for example, brings both joy and hope to senior citizens. And teenagers can make exceptional mentors, teach younger children basic math, or instill the love of reading in a child.

—Kathleen Bachynski

Pairing teens up with professionals in a mentor relationship could help the "crisis at home." If the professional's services were needed by the Freedom Corps, the teenager could help out. While teenagers cannot perform the duties of a nurse, for example, we can hold and carry their equipment, freeing their hands. Teenagers today can also make an effort to understand people of other countries. Perhaps a radio show that traveled throughout the world interviewing youth of different countries could help teenagers (and adults) better understand and appreciate other cultures and experiences.

—Elspeth Iralu

I think one of the best ways that teenagers can make a difference is by mentoring or tutoring children. Children can relate to us more easily because of our relatively young age, and many more volunteers are needed to meet the demand for this kind of volunteer work. If enough of us pitch in, we could have a great positive impact on the children of this country.

—Patrick Mihelich

The best thing we can do is care. The other day my English teacher was talking about how it bothers him to see how few people really care—they'll do their jobs, but without passion or involvement. Those words came back to me later that day, at a drama rehearsal. The director hadn't shown up, so I, as student director, was in charge. I found myself wishing I could just go off and miss rehearsal and not even be bothered by it, and then I thought, ***no, I have to care***. Sure it's a lot harder that way: people who care have more to do, more to worry about, more to be bothered by. But if we want anything to get better, we have to care.

—Jeremy Stoller

For community service, we have traditional nationwide student groups such as the Boy/Girl Scouts and the National Honor Society, but no student organization has yet fully developed to help students adjust to this new era of globalization. Through the Freedom Corps, we can begin dialogue, exchanges, and even meetings with teens from nations across the world. Combining this with our values of service and determination, we will indeed help to "extend American compassion throughout the world." We will also gain in the process of working with students from around the globe a true sense of pride and citizenship.

—Shelby Yu

Crossword Solution:

K	I	S	S	I	N	G	E	R	■	■	S	H	A	W
I	K	E	■	■	■	P	L	A	T	O	■	E	R	A
N	C	■	N	A	T	■	F	R	A	U	D	■	M	T
G	■	B	A	K	E	R	■	E	X	T	R	A	■	E
■	M	E	N	C	K	E	N	■	■	R	I	D	■	R
■	E	T	C	■	S	A	N	■	P	A	V	E	■	G
C	I	T	Y	■	■	G	E	O	R	G	E	■	S	A
H	E	Y	■	D	O	A	■	F	O	E	■	P	E	T
U	R	■	W	I	N	N	I	E	■	■	R	O	V	E
R	■	S	I	R	E	■	A	L	E	■	O	L	E	■
C	■	I	N	K	■	■	L	I	N	C	O	L	N	■
H	■	B	O	S	C	H	■	A	D	A	M	S	■	C
I	N	■	S	O	F	A	S	■	S	T	Y	■	C	O
L	B	J	■	N	O	D	E	S	■	■	■	H	E	N
L	A	W	S	■	■	J	E	F	F	E	R	S	O	N

Creative Minds Imagine

Numbers: A Love Poem

by Gabrielle Vance

It was an unknown emotion
coiled, painful, behind my ribs
a stone settling in my stomach,
a series of disjointed actions
inspired and intensified
by the inky geometry, the fluid numerals
arrayed across the page.

Their curves cradled enigmas,
their lines glaring separations of white and white.

The numbers, purposeful and decorated,
organized and mystifying,
the problem forming a blazing
blue question mark.

Sometimes the pathetic chafings of my pencil
dispel that blue burning brand,
more often the numbers retain their dignity,
cackling from their thrones.

Love billows in my brain,
love for the numbers, for the wiry squat strength of 5,
for the mesmerizing curves of 8, for the defiant void of 0,
but there is more, and I love too
the machinations behind the numbers
shadowy forms below the surface of the page.

Gabrielle Vance is a seventh-grader at Dzantik'I Heeni Middle School in Juneau, AK. Gabrielle loves math, poetry, and skiing. She hopes to become a famous author but will settle for many other professions, as well.

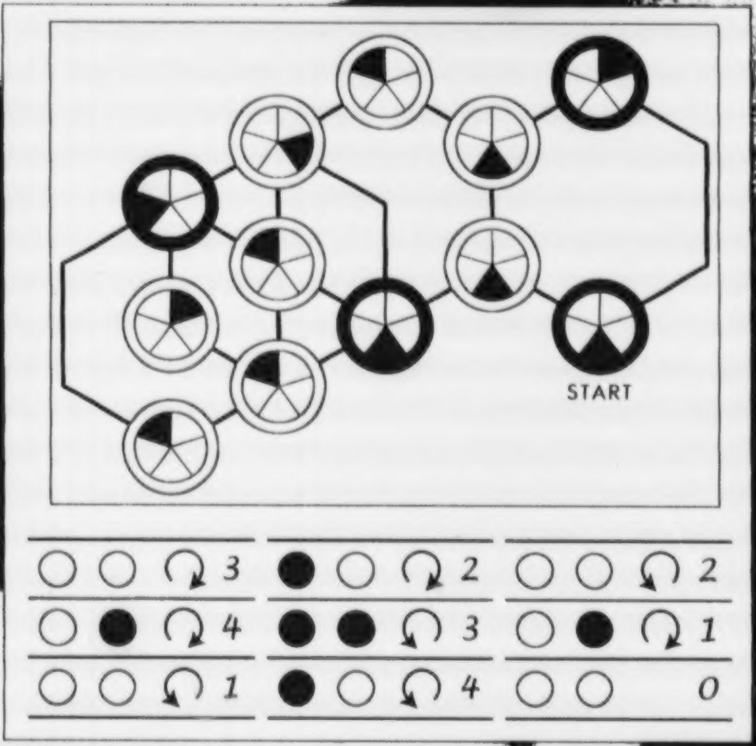
Show Your Creative Side

Creativity is what this page is all about. So send us your poems, your photographs, your stories. Send a creative essay, or slides of your paintings and sculptures.

We're always considering creative work for upcoming issues. Send yours to Melissa Hartman at mhartman@jhu.edu or CTY/Imagine, 3400 N. Charles Street, Baltimore, MD 21218.

Knossos Games

by Tim Boester



The Goal

To make all the black wedges point downward, like the Starting circle.

[illegible] Rules

[illegible] from circle to circle, moving along the black [illegible] have two possible opening moves: to [illegible] rimmed circle northwest of Start or the [illegible] rimmed circle north of Start. The latter, [illegible] is a legal one.

[illegible] rimmed outer band. When you [illegible] will rotate according [illegible]. For example, if you jump [illegible], the wedge inside [illegible] four "notches" in the

Solution to Knossos Games in our January/February issue:

Cookbook was $20, with 15% discount now $17.
Mystery was $15, with 20% discount now $12.
Poetry was $16, with 25% discount now $12.
Biography was $30, with 40% discount now $18.
Architecture was $46, with 50% discount now $23.
Total cost of books after discounts: $82.

A graduate student in educational psychology at the University of Wisconsin, *Tim Boester* now has additional puzzles on his home page: http://homepage.mac.com/boester

Imagine...

JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

PORTUNITIES AND RESOURCES FOR ACADEMICALLY TALENTED YOUTH Volume 9 Number 5 • May/June 2002

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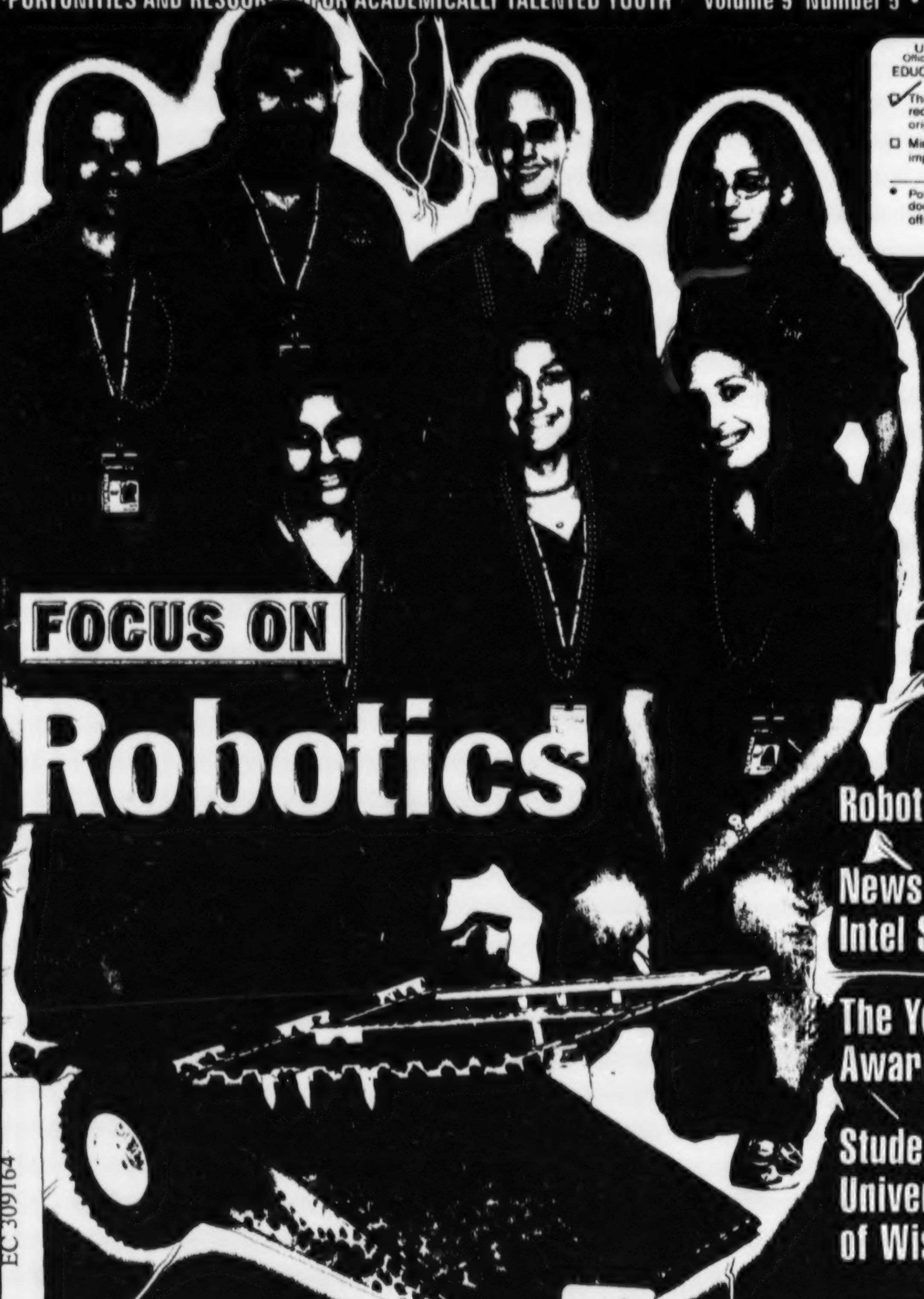

FOCUS ON

Robotics

Robots Rule!

News from the Intel STS

The Young Naturalist Awards

Students Review University of Wisconsin

EC 309164

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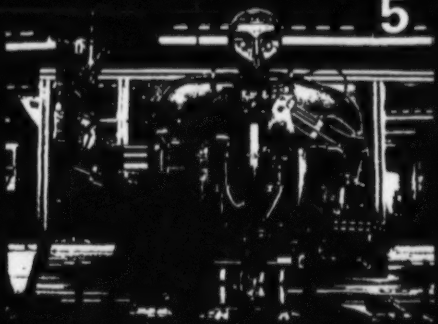
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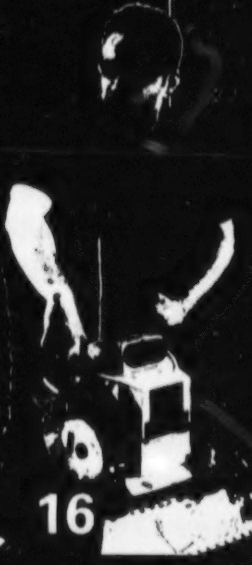
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ImaGiNe...

)pportunities and Resources for Academically Talented Youth*

SSN 1071-605X Volume 9 • Number 5
May/June 2002

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JOHNS HOPKINS
UNIVERSITY
Center for Talented Youth

'ublished five times a year—September/October, November/)ecember, January/February, March/April, and May/June.

'eriodicals Postage paid at Baltimore, MD, and additional nailing offices.

'OSTMASTER: Send address changes to *Imagine*,
IHUP, Journals Division, P.O. Box 19966, Baltimore, MD 21211.
magine is published by the Study of Exceptional Talent (SET) it The Johns Hopkins University Center for Talented Youth.

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\nnual subscription: $25.00
nstitutions: $30.00

\ddress subscription inquiries to:
magine
IHU Press, Journals Division, P.O. Box 19966,
Baltimore, MD 21211-0966
800) 548-1784 • fax: (410) 516-6968
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COVER PHOTO: Team Chomper of Miami, FL—participants in the Inaugural BattleBots IQ Tournament at Universal Studios Orlando.
© BattleBots Inc. Daniel Longmire, Photographer

Parents' Choice Award
2001 Winner

Visit our Web site for
this issue's links
cty.jhu.edu/imagine

Announcements

See You in September

We hope you have an exciting summer planned. Although we don't publish an issue over the summer, the *Imagine* staff will be very busy preparing for the great lineup of topics we've set for the 2002-2003 volume year:

September/October	**History**
November/December	**Biological Sciences**
January/February	**Language & Linguistics**
March/April	**Mathematics**
May/June	**Visual Arts**

If you have a story idea for any of these issues, now is the time to let us know! Send an e-mail to the editor, Melissa Hartman, at mhartman@jhu.edu or write to her at CTY/ Imagine, 2701 N. Charles Street, Baltimore, MD 21218-9949.

Join the Readers Panel

We're looking for 6–10 readers for the 2002-2003 Readers Panel! Share your ideas with the editorial staff and other panel members to help make *Imagine* even better than it already is. Send us a paragraph that tells us about you and why you'd like to be a panelist. Be sure to include your age, grade, and address. E-mail your paragraph to the assistant editor, Michelle Federico, at mfederico@jhu.edu.

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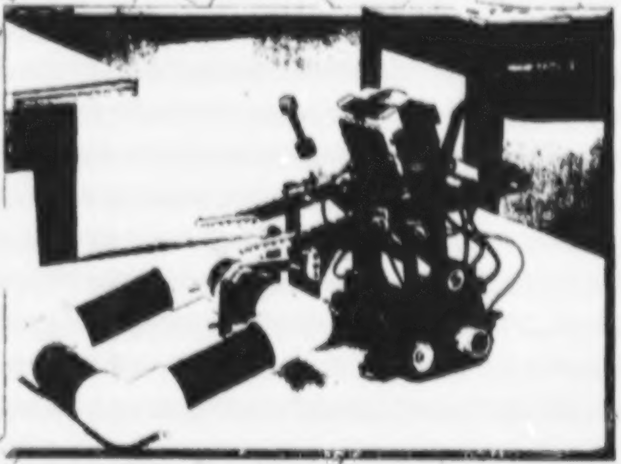
Botball

LEGOs IN MOTION

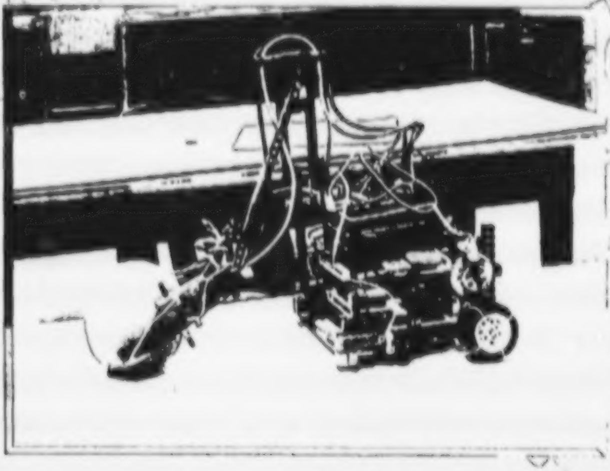
by Monica Garner

Three years ago, my brother joined the school Botball team. When I saw him building robots out of LEGOs, I thought it would be fun to play with LEGOs and learn something at the same time.

This year, I joined the Botball team, and it was just as much fun—and a lot more challenging—than I thought it would be.



Monica's team built two robots to complete this year's tasks. Above: Robot to handle Ping-Pong balls. Below: Robot to move foam ball.



Each year, the KISS Institute for Practical Robotics provides a new challenge for Botball teams. Coaches attend a three-day seminar where they learn about robotics. They are also issued the kits from which we will build our robots for that year. The kits include LEGO parts as well as a Handy Board, the programmable part of the robot. Using only parts from the kit, teams then build autonomous robots.

This year's task had two parts. First, our robot had to retrieve Ping-Pong balls from baskets and place them in different locations on the competition table. Second, our robot needed to locate a foam ball and carry it to a tall basket. Because a Botball match lasts for only 90 seconds, many teams build two robots, each to perform a different part of the task. We had six weeks to figure out our strategy and build the robots.

The team divided in half to tackle the two main elements: building and programming. I worked primarily on building the robot. After discussing how the robot should be built to accomplish its task, we started putting pieces together to find what would work best. We began by building a claw and an arm to retrieve the foam ball but had some trouble getting the claw to grasp the ball. While some team members figured out what was wrong with the arm, others started building the body.

Even after all of our hard work, sometimes we would pick the robot up from the table and it would just fall apart in our hands. Back to reconstructing we would go.

When we thought our robot couldn't get any better, we joined up with the programmers. We found out very quickly that our robot wasn't as perfect as we thought it was. When we started the program to make it go forward, the robot began to move but then fell to pieces. Yet again, we went back to reinforcing it.

This trial-and-error aspect of getting our robot to work was very frustrating. Many times we thought we were finally finished with programming, but then the robot turned the wrong way or didn't stop like it should have. We learned that in

Interactive C, one out-of-place semicolon can mess up the whole program.

When we finally removed all the bugs, the program was loaded onto the Handy Board, and we were ready for the next challenge: the regional Botball competition. During the seeding rounds, we realized that the competition tables were very slick; the robots that worked beautifully at school were now just going in circles. We were in big trouble if we couldn't do something about it quickly!

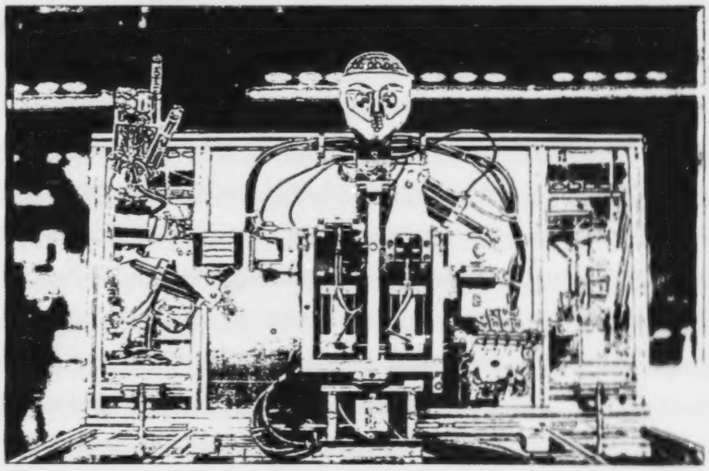
After the disastrous seeding round, we regrouped and decided to distribute the robot's weight toward the back. But there was no time to test this change. We wouldn't find out if it worked until we were called to compete.

When the lights came on, our robots went forward for about two seconds, then started to turn around in circles. At the same time, the other team's robot turned the wrong way and was heading straight for our Ping-Pong balls! After it released almost all of our balls, the round was over, and even though our robots were dancing in a corner, we won the round! We learned that winning sometimes requires not only good strategy but good luck.

We will give our robot another go at it this June at the national competition. We learned a lot from the state competition, and our team will be ready for the challenge again! ■

Monica Garner is a sophomore at Eisenhower High School in Lawton, OK. Beyond robotics, her interests include playing the violin, drawing, traveling, camping, and rappeling.

SELECTED ROBOTICS COMPETITIONS



"Jack," created by students at Newberg High School in Oregon, won the Judges' Choice Award at the 2001 RI/SME Robotics Challenge.

Photo courtesy of Terry Coss, Newberg High School.

B.E.S.T. Robotics Championship

Guided by industry and academic coaches and using a kit supplied by B.E.S.T., teams of middle- and high-school students build radio-controlled robots in six weeks to complete the year's defined task. This regional competition has 20 hub sites in Alabama, Arkansas, Illinois, Kansas, Kentucky, New Mexico, Oklahoma, and Texas; winners of hub contests advance to the Texas B.E.S.T. Championship. *www.bestinc.org*

Botball

Teams of middle- and high-school students build autonomous robots in six weeks to complete the year's defined task. The contest sponsor, KISS Institute for Practical Robotics, provides teacher training, kits, and technical support. Teams compete at regional events; winners of those advance to the national competition. *www.botball.org*

F.I.R.S.T. LEGO League

Using LEGO Mindstorms™ kits, teams of students age 9–14 build robots to meet the year's challenge and then compete at the local and state level. See page 14 for insights from some of this year's participants. *www.usfirst.org/jrobtcs/*

F.I.R.S.T. Robotics Competition

Mentored by industry and university engineers and using a standard kit, teams of high school students build a robot in six weeks to complete the year's defined task. Teams compete at regional events and may qualify for the national competition in any of several ways (see www.usfirst.org/robotics/res_art9.htm). See page 12 for a full article about this contest. *www.usfirst.org*

RI/SME Robotics Challenge

Individuals and teams of students in middle school through college build robots to enter in any of 18 categories, each of which is designed to test students' skills in a particular area of manufacturing, technology, robotics, and automation. Sponsored by Robotics International of the Society of Manufacturing Engineers. *www.sme.org* [Click on Youth Programs, then Student Robotic Challenge.]

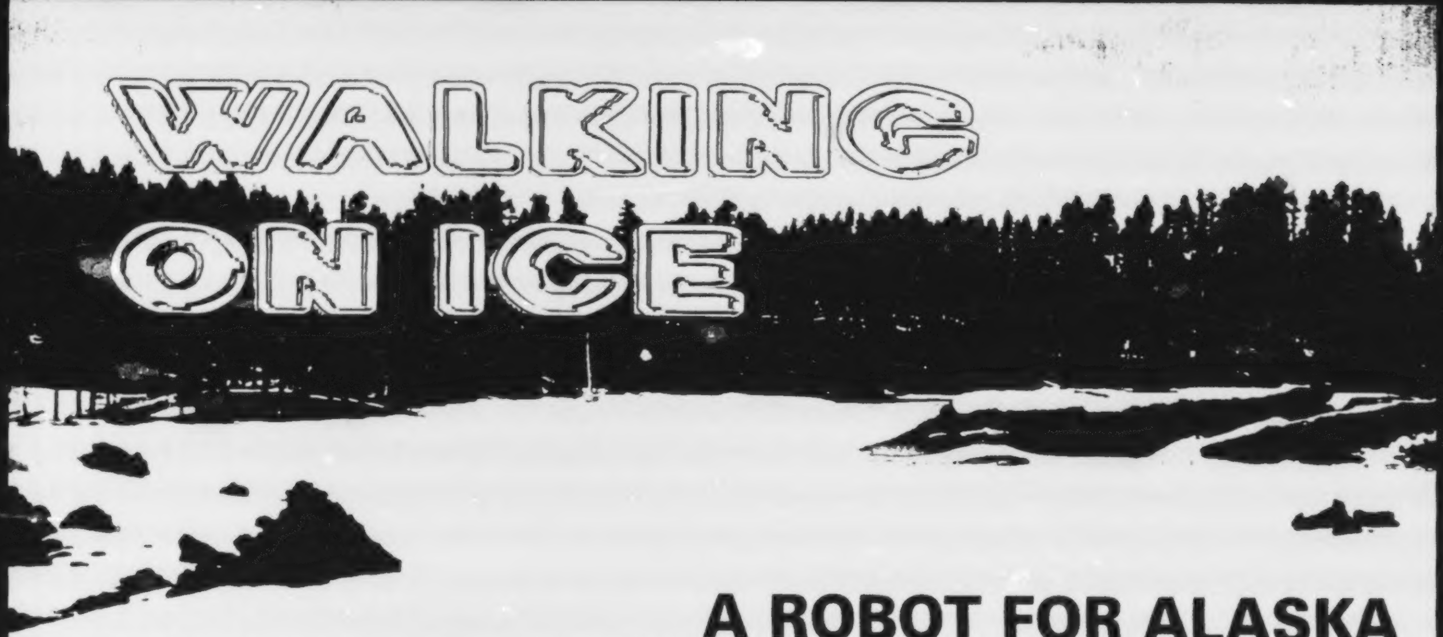
RoboCup Junior

Students in elementary school through college work in teams to complete one of three challenges: soccer (two-on-two matches of autonomous mobile robots), rescue (robots rescue victims from simulated hazardous sites), or dance (one or more costumed robots perform to music). *www.robocup.org/junior/* OR *http://satchmo.cs.columbia.edu/rcj/rcj2002/*

Trinity College Fire-Fighting Home Robot Contest

Contestants build autonomous robots that navigate a model of a house to locate and extinguish a lit candle. Four categories encourage participation by roboticists of all ages and abilities: junior (grades 8 and below), high school, senior (anyone beyond high school), and expert. *www.trincoll.edu/events/robot/*

WALKING ON ICE



A ROBOT FOR ALASKA

by Hanna and Heather Craig

The first time we encountered the wonder of electronics, we were two 10-year-old girls tearing apart our family's broken VCR. After a few hours of dismantling, we discovered, among other gadgets, miniature electric motors. Although we never quite managed to put the VCR back together, we did make our own creations from the parts. Being twins, we were always working on projects together and bouncing ideas off each other; we always had the benefit of an accomplice in our endeavors. In elementary school, we entertained ourselves by building electric motors and other small gadgets, but we never imagined how far our interests would take us.

First Steps

Three years ago, we signed up for the Anchorage School District's Mentorship Program, in which high school students are paired with a mentor in the student's field of interest. We excitedly wrote "robotics" for our field of interest. To our surprise, we discovered that Anchorage is home to a company specifically geared toward robotics and inventions—Envision Product Design and Prototype Shop—and we soon became apprentices to John Pursley, Envision's owner. John agreed that we could spend half our time working on a personal project and the other half assisting him with his work. From our first day "on the job," we realized that John was extremely knowledgeable, patient, and encouraging as a mentor. Any time we made a mistake, John would simply correct us and give us the time and tools to fix our error.

Near the beginning of our mentorship, we told John of our desire to build a robot. Although we did not know what we wanted our robot to be able to do, John supported our enthusiasm. We quickly began brainstorming during our weekly sessions.

Because we live in Alaska, we wanted to create a robot for an Alaskan purpose. We discarded a series of ideas, such as a robot that would measure ice thickness. Eventually, we hit upon the idea of a rescue robot for people who fall through ice on frozen lakes. Currently, no effective rescue method for these situations exists; often, rescue efforts result in additional people falling through thin ice. We decided to undertake the task of building a rescue robot that could function in harsh winter conditions.

Our idea was simple: a device that could venture out onto the ice while emergency rescue workers remained on solid ground. A rescue worker would use a control box to navigate the robot to the victim, who could either hold on to the robot or get into an attached sled. A tether connecting the control box to the robot would serve the dual purpose of an electrical connection and a means of pulling the victim to safety.

Ice-Crawler is Born

Because we did not want our robot to fall through thin ice, we designed it with a long, slender frame, to spread its mass over a large surface area, and built it using lightweight materials. As we began to envision how our robot would look and function, we decided to name it "Ice-Crawler." The basic structure consists of two silicone-reinforced rubber tracks connected end to end. It uses three motors: two for the drive system and one for steering. A Basic Stamp II microcontroller*, in conjunction with two Motor Minds, controls Ice-Crawler's speed and allows encoder feedback. To aid the controller in locating the victim, we also mounted a small video camera on it.

Throughout the construction, we delved into many facets of engineering; we learned about frame design, electronics, and programming. At first, we needed extensive advice and help. After the first year, however, we became more independent as our knowledge base expanded. Generally, Heather focused on the electronics and Hanna worked on the programming, and we both did the mechanical and construction work.

We had studied electronics and robotics before we began Ice-Crawler, but our

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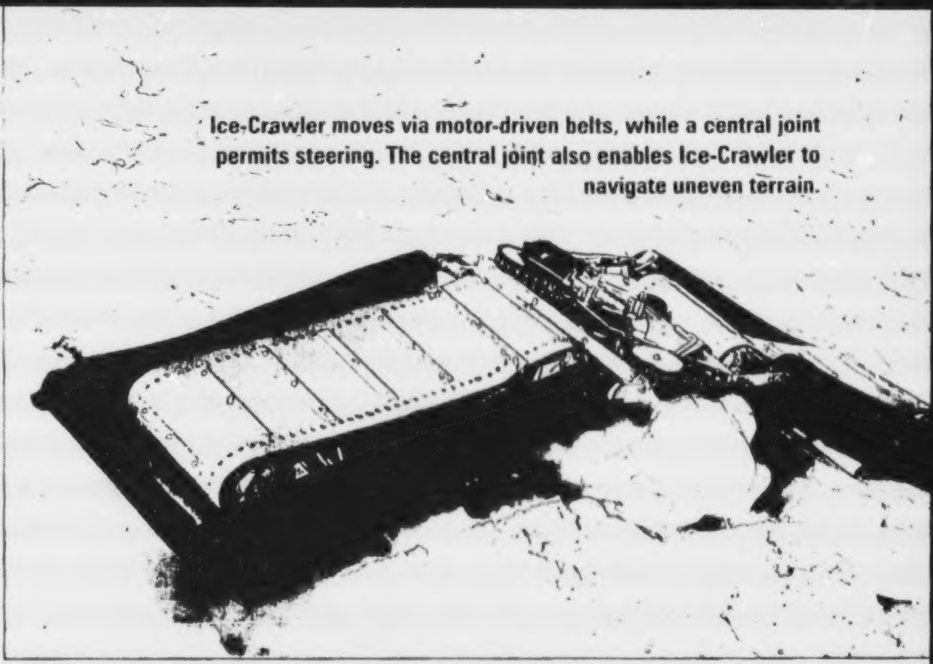
* The Basic Stamp microcontroller, available from www.parallaxinc.com, is great for simple projects. It can be programmed in PBASIC code through the serial port on a computer and uses EEPROM memory.



Ice-Crawler moves via motor-driven belts, while a central joint permits steering. The central joint also enables Ice-Crawler to navigate uneven terrain.

knowledge grew as Ice-Crawler progressed. For example, we both had experience in soldering before our mentorship, but John helped us refine our soldering technique. Eventually, we could solder Ice-Crawler's components without wondering if the wires would snap (as they did in many of our previous projects). Throughout the project, we became skillful at using a roboticist's tools: the band saw, drill press, multi-meter, oscilloscope, and welding equipment.

In Anchorage, snow covers the ground for eight months of the year, so testing Ice-Crawler was a simple process of stepping outside our front door! Later, we took Ice-Crawler to a nearby lake to test it on ice. Ice-Crawler effectively traversed both snow and ice. Unfortunately, it moved rather slowly, obviously not ideal for emergencies. To keep costs down, we had used parts that were not specifically designed for Ice-Crawler, purchasing motors for the drive mechanism from surplus suppliers on the Internet, for example. If Ice-Crawler is manufactured commercially, the motors and other parts will be replaced with more optimal components, which will enable faster movement.

Throughout the process, we encountered problems and constantly had to redesign, rebuild, and retest. Often we became extremely frustrated and—being sisters—took our anger out on each other. Eventually, we learned, when frustrated, to just step away and take a break. In any intense project, a person must learn both patience and self-discipline. Teamwork is also crucial, especially in our case!

Ice-Crawler Competes

After two years of continual redesign and long evenings in the lab, we completed Ice-Crawler; and in the spring of 2001, we entered the Alaska State Science and Engineering Fair. To our surprise, we placed first! Winning at this level allowed us to join 1,500 students from around the world for the 2001 Intel International Science & Engineering Fair (ISEF) in San Jose, California. During a week of exciting events, including a Sugar Ray concert and a Q&A session with a panel of Nobel laureates, we managed to forget any stress involved in competition and just have fun. The day of judging went well and we placed second overall in the team category.

That fall, Ice-Crawler was sitting in our garage gathering dust when we heard of the Siemens Westinghouse Science & Technology Competition, and we immediately decided to enter. We were chosen as regional finalists and traveled to Berkeley, California, for the Western Regional Competition. Set on the beautiful Berkeley campus amidst protests and pep rallies, the competition was a great experience and inspired us to apply to UC-Berkeley. We placed first and proceeded to Washington, DC, for the national competition, which was equally exciting. We placed second nationally and will share a $50,000 scholarship.

Throughout these competitions, we met interesting people from around the world. The projects amazed us, although many were beyond our level of understanding. Being surrounded by other students who are passionate about their projects is a thrilling and inspiring experience. Even if we do not study robotics in college (we both have varied interests), we have many great experiences to reflect on. Ice-Crawler has made an imprint on our lives, from the robotics laboratory in Anchorage to the competitions in San Jose, Berkeley, and Washington.

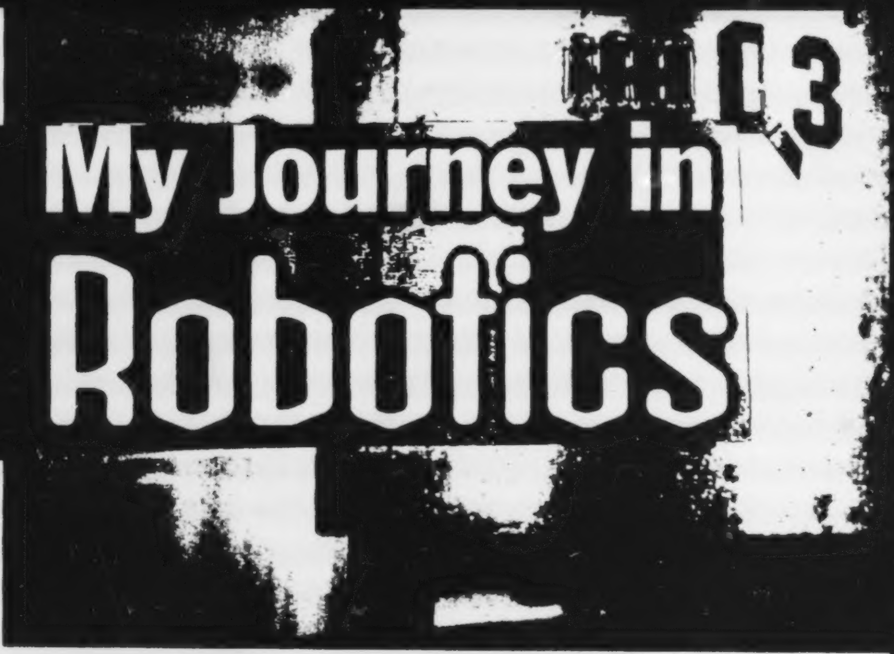
In the future, we hope that arctic rescue teams everywhere will be equipped with their own Ice-Crawler. Several Alaskan search-and-rescue teams have already expressed interest in having one. We are now patenting Ice-Crawler and hope one day to see our invention save someone's life. ■

Hanna

Heather

Born and raised in Alaska, ***Hanna*** and ***Heather Craig*** are seniors in high school and will be attending college next year. Hanna enjoys photography, unicycling, managing her school's soccer team, and playing with her cat, Brittney. Heather enjoys black and white photography and is a member of her school's science and math clubs.

For more about the ISEF and Siemens Westinghouse Science & Technology Competition, see page 23.



My Journey in Robotics

Three years ago, Eser Chamoglu wrote an article for Imagine about a robot he was building for his first robotics competition. We decided to follow up with Eser, now a freshman at Stanford University, and asked him to describe how his robotics interests have evolved since then.

by Eser Chamoglu

Some people view robots as elaborate props in science fiction thrillers, others as expensive entertainment appliances. To me, however, robots are more than that. Robots are my entertainment, my after-school job, my hobby, my expertise, my passion.

My robotics journey began in eighth grade, when I constructed Hector, a crude remote-controlled robot warrior that I planned to enter into Robot Wars (now broadcast as BattleBots). After Hector was destroyed in transport, I attended the competition as a spectator and saw the crowd go wild over complex, mechatronic devices constructed by professional engineers. Though I realized that Hector wouldn't have beaten those giants, I also saw how excited people could become over robots. I was in robotics to stay.

Fighting Fires, Autonomously

After Hector's unfortunate demise, I decided to devote my attention to creating a robot that would interact autonomously with the world around it. Over the next few years, I built two robots, Q and Q2, to enter the Trinity College Fire Fighting Home Robot Contest. This contest called for each participant to build an autonomous mobile robot that could find its way through a maze, avoid obstacles, and put out a lit candle.

Each of my robots used two on-board computers for running the navigation and control software, a real-time operating system I developed to switch the computer's resources from one task to another, a laser range finder for sensing obstacles and creating a map of the robot's surroundings, two servo motors and a motion control card I built for moving the robot around, a pyroelectric sensor for sensing the heat from the candle, and a computer-controlled aerosol can for putting out the fire.

My approach was complex and probably overkill for the task at hand; however, I learned a tremendous amount about building complex systems that incorporated mechanical, electrical, and software subsystems. The challenge was in integrating these systems—a challenge that eventually led me to build Q3.

A New Way to Build Bots

After Q and Q2, I realized that there are two major problems for most people who are developing robots. First, there are no hardware or software standards in the robotics industry, so hardware or software created for one robot may or may not work with another robot. Second, software written for a robot must be tested on an actual robot, which means that the hardware must be completed before the software can be tested. Robots are expensive to build and their hardware isn't always functional, so there may not always be a robot around to test the software on.

If there were an easy and affordable way to reuse robot software and hardware, and a simple way to test robot software without the robot, then it would take less time and less money to create robots. I created a system called QBots to solve this problem and Q3 to test my solution.

QBots allows engineers to develop, test, and debug application software for mobile robots in a simulation, without requiring an actual robot. Once the application software has been written for a robot, it can be run on a virtual robot in the simulator. After the software has been debugged, it can be uploaded to the actual robot.

To ensure that the application software behaved on the actual robot exactly as it did in the simulator, I created a set of reusable software modules: one module to control the robot hardware and one to complete high-level tasks such as recognizing and avoiding obstacles.

The software modules for hardware control involve a common application protocol interface (API). Just as all cars have the same set of controls that let drivers operate different types of cars without worrying about how the engine is built, the QBots API requires software engineers to familiarize themselves only with the QBots software, not the intricacies of the sensors, motors, and computers on the robot. Additional QBots software modules can be created to support different brands and types of sensors and motors. As a result, hardware and software can be shared and reused among different robots that use the QBots system.

The second set of software modules in the QBots system implements obstacle avoidance, robot navigation, motion planning, and pattern recognition algorithms. These modules use data collected from the robot's sensors to create a representation of the robot's surroundings, which can be used to move the robot from one point to another. As the basis for my navigation algorithms, I used the Voronoi Diagram, a mathematical construct that allows software engineers using the QBots platform to give the robot relative motion commands, such as "take next left" and "go to the end of the hall," instead of absolute commands that specify the exact distances that the robot should travel. This makes the robot more resilient to changes in its environment and more likely to behave realistically in simulation.

When I was in 11th grade, I entered the QBots platform into the Intel Science & Engineering Fair (ISEF) in the Computer Science division, emphasizing the work I did developing the navigation algorithms. QBots won 13 awards at the state and local levels and 7 awards at the national competition.

Going Pro

My experience at the ISEF made me realize that my passion for developing robots could yield more than just interesting research projects—it could also lead to practical solutions. I wanted more from QBots than academic awards—I wanted real engineers to use it to tackle real-world problems. I needed to find a way to turn QBots into a business.

After the ISEF, to gain firsthand experience in the robotics industry, I started looking for a summer job at a robotics company. Within a few weeks I found an opportunity at Honeybee Robotics, which designs and builds highly customized robots for the aerospace industry. Working with the engineers at Honeybee Robotics was a fantastic experience; part of the fun was seeing how a multidisciplinary team of engineers works together on a project. I learned that although it's possible through sheer force of will to build a robot alone, a team approach makes building robots practical. I realized that I could make QBots into a better product by assembling a team to work on it.

At the 2001 ISEF, Eser won 7 awards, including Best Use of a Personal Computer and an award from NASA.

A few months ago, as a freshman at Stanford University, I decided to pursue my passion for turning QBots into a business by entering the annual Stanford Entrepreneurs Challenge. The Stanford E-Challenge is an annual business plan contest open to students, faculty, and postdoctoral students who are starting companies. Finalists are judged by a panel of venture capitalists from Silicon Valley, who award seed money to the finalists.

I hadn't yet assembled a team, but I thought that entering the contest would give me valuable feedback about QBots. In January, the QBots platform won the E-Challenge "Innovation from a Young Entrepreneur" award. Since then, I have worked on creating a more polished prototype, and I have begun putting together a team of fellow students to work on the QBots platform.

The response to QBots showed me that people inside and outside of industry are genuinely excited by the potential of robotics as a practical technology. This excitement, combined with new and less expensive technologies, is creating an environment that will foster enormous growth in the robotics industry. Through QBots, I have already sensed the possibilities, and I look forward to the new challenges that lie ahead. ■

Eser Chamoglu is a freshman at Stanford, where he is a member of the ski team. An avid reader, he also enjoys surfing and playing golf. Eser welcomes e-mail from *Imagine* readers interested in robotics: eser@stanford.edu

Selected Resources in ROBOTICS

Axis (left) vs. Steven Seagal at the Inaugural BattleBots IQ Tournament for middle-and high-school students.

©2002 BattleBots Inc. Daniel Longmire, Photographer

COMPETITIONS

See page 5 for information about robotics competitions.

SUMMER PROGRAMS

Cybercamp
Students age 10 and up choose one-week courses offered at universities across the country. In the robotics course, students build and program a tabletop robot that they enter into competition at the end of the week and take home at the end of the program. Application deadline: May 31.
www.giantcampus.com/Cybercamps/courses.asp

NC State Autonomous Robotics Summer Workshop
In this two-week program, high school juniors and seniors design and program autonomous robotic cars, which they take home at the end of the program. Application deadline: April 1.
www.engr.ncsu.edu/students/summer_programs/

Robotic Autonomy
This new seven-week summer robotics camp for high school juniors and seniors is offered by Carnegie Mellon University in collaboration with NASA/Ames Research Center. The university-level course introduces students to the electronics, mechanics, and computer science of robotics while allowing them to build, program, and operate vision-based robots, which they take home at the end of the program. College credit awarded. Admission is highly selective. Application deadline: April 1.
www-2.cs.cmu.edu/~robocamp/

Worcester Polytechnic Institute Frontiers
In addition to various other science courses for high school juniors and seniors, the Frontiers program offers a two-week course in robotics modeled on the FIRST robotics competition. Students work in teams to brainstorm, design, build, and test a robot that will compete in an end-of-session tournament. Application deadline: May 15.
www.wpi.edu/Admin/AO/Frontiers

BOOKS

The titles below are just a few that have been published in the past few years. If you want to learn about new robotics books as they are published, subscribe to the e-newsletter offered by *www.robotbooks.com*, a site that offers a range of titles for roboticists of all ability levels.

Build Your Own Robot! by Karl Lunt (A. K. Peters, Ltd., 2000).

Creative Projects with LEGO Mindstorms by Benjamin Erwin (Addison-Wesley, 2001).

Flesh and Machines: How Robots Will Change Us by Rodney A. Brooks (Pantheon Books, 2002).

Mobile Robots: Inspiration to Implementation by Joseph L. Jones et al (A. K. Peters, Ltd., 1999).

The Robot Builder's Bonanza: 99 Inexpensive Robotics Projects by Gordon McComb (McGraw-Hill Professional Publishing, 2000).

Robot Building for Beginners by David Cook (Apress, 2002).

WEB SITES

Android World
A site all about robots that look like humans. Includes an amazing number of links to more robot-related sites.
www.androidworld.com

Educational Robotics Cyber Laboratory

A technology curriculum site for teachers and students who want to bring robotics into the school. Appropriate for grades 6–12, this curriculum introduces aspiring roboticists and their teachers to sensors, motors, gearing, computer processors, and computer programming. *www.kipr.org/curriculum/curriculum_intro.html*

Machine Intelligence Laboratory

Read about some of the cool projects, past and present, to come out of the University of Florida's Department of Electrical and Computer Engineering. *www.mil.ufl.edu*

NASA Robotics Education Project

Links to events and competitions are great for teachers and students, but we especially love the daily Robot News and Cool Robot of the Week on the home page. *http://robotics.nasa.gov*

Netsurfer Robotics

Subscribe to this free e-zine to keep up with robotics news, toys, books, events, and more. *www.netsurfer.com/nsr/*

Robot Café

An easy-to-navigate subject directory focusing on robotics. Be sure to visit—and add your robots to—the robot gallery. *www.robotcafe.com*

The Robot Menu

See what other robotics hobbyists have created, and then post your own creation. *www.robotics.com/robomenu/*

The Robotics Institute

Get a glimpse of some of the amazing work being done at Carnegie Mellon—from mobile robots to medical robotics. *www.ri.cmu.edu/lab_lists/*

Robotics: Sensing, Thinking, Acting

When the Carnegie Science Center's Robotics exhibit came to The Tech Museum of Innovation, The Tech designed this excellent Web site to go with it. Learn about the history of robotics, robot art, ethical questions about robotics, and more. *www.thetech.org/exhibits/online/robotics/*. To find out if Robotics is coming to a museum near you, visit *www.carnegiesciencecenter.org/exhibits/robotics_schedule.html*

Robots 4 Kids

This site was designed for homeschoolers, but the links here are great for all student roboticists. *www.gomilpitas.com/homeschooling/explore/robots.htm*

Tech Geek: Building a Robotics Community

You'll spend a lot of time here on the Projects page alone, but be sure to check out Resources, News, and Views as well. *www.techgeek.com*

MAGAZINES

Nuts & Volts

Columns in this monthly tabloid-size publication include Amateur Robotics, Electronics Q&A, and Laser Insight. *www.nutsvolts.com*

Robot Science and Technology

This bimonthly magazine features in-depth reports on real home, classroom, and sport robots. The Web site has lots of useful links, too. *www.robotmag.com/*

201
FEDS 201
201

At the controls during this year's national FIRST Robotics Competition: Team #201, the Visteon FEDS of Rochester High School, Troy, Michigan.

Photo courtesy of FIRST.

In the FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition, teams of high school students and their mentors—volunteers from corporations and colleges—build competitive robots in six weeks. Ameya Agaskar has been on his school's FIRST Robotics team for three years. In this article, he takes us behind the scenes to show us what happens in those six weeks.

FIRST Days

A SEASON IN ROBOTICS

by Ameya Agaskar

January 5, 2002: Our team gathered to watch a satellite broadcast of the 2002 Kickoff, where the game for this season was revealed. Two teams (called "alliances" because robots made by different schools are paired randomly at competition) of two robots each would compete on a field with three moveable goals and forty balls. The score at the end of a round would depend on the number of balls in each goal and the final position of the goals and the robots. We now had six weeks to design, prototype, build, program, test, and debug a fully functional robot!

Week 1: Our team of 20 students, 2 teachers, and 10 mentors—volunteers from Bristol-Myers Squibb, Morehouse Engineering, and Worldwater, Inc.—split into two groups: the playing field group and the functional design group. The first group began to build a playing field that would be used to test the robot, while the functional design group (of which I was a member) met to brainstorm and determine a plan for the robot.

We examined the kit of parts to see what we had to work with and read the rules carefully to see what additional parts were permitted. We then discussed how the robot would complete various tasks, such as moving goals around and scooping up balls to place into goals. We could try to make a "jackbot" (a jack-of-all-trades robot) that would move goals and pick up balls; or we could make a "brutebot," a powerful robot that would merely control the goals and rely on our alliance partner to put balls in the goals.

After days of heated discussion and debate, we settled on a plan: There would be one goal-grabbing arm on each side, and a single goal-grabber in the rear. The front of the robot would have a mechanism to pick up balls and put them into a goal being dragged behind the robot.

Week 2: Meeting daily, some of us modified robots from previous years to test ideas for the ball-scoring mechanism. Others made drawings in AutoCAD and constructed small wooden prototypes of goal-grabbing arms. Meanwhile, we had decided that the drive-train would need a variable transmission so that the robot could move with high speed or high torque, so some of the mentors and students got to work designing the gearbox.

Week 3: Even while the prototyping continued, work on the final chassis of the robot was begun. The gearbox was fabricated and connected to the drive motors, and we began initial programming so that we could test the robot.

When the first test program was uploaded, the robot began spinning in circles. When we moved the joystick to the side, it went forward instead of turning. It didn't respond correctly to one of the switches. Everyone's initial reaction was to blame the programmer (me), but, as I insisted after double checking the code, the program wasn't the problem! We finally figured out that the joystick wasn't properly calibrated, one of the speed controllers was wired incorrectly, and one of the control switches was defective.

Weeks 4 & 5: Small groups formed to design and build more parts. One group built a deadly looking pneumatic arm (affectionately known as the Sickle of Death) and determined the best way to mount it on the rear of the robot. Others built two more goal-grabbing arms, one for each side of the robot. A student with experience building fiberglass rockets built a fiberglass roller that would shoot balls into a goal being dragged by the Sickle.

Next, work began on the control system. Switches, potentiometers, and LEDs were housed in a control box. Meanwhile, the robot's central processor, circuit breaker, fuses, electronic speed controllers, relays, limit switches, and sensors were arranged to make the most efficient use of the space available.

When most of the components were built, it was time for the first weight check. Components already built were massed, marked with a sticker, and placed aside. Those not yet built were accounted for through estimates entered in an Excel spreadsheet. When the final tally of 105 pounds was announced, those of us who had been on the team in previous years were incredulous. Normally, by this point in the process we had already passed the limit and were scrambling to find ways to lose weight. We took the obvious next step: a recount. Lo and behold, there was a mistake in the spreadsheet, and we were actually more than 10 pounds overweight.

Week 6: A mad rush of activity. We drilled holes and made other adjustments to decrease the robot's weight. We also made last-minute adjustments to the program, testing and debugging each function until it ran smoothly. Finally, we shipped the robot to Rutgers University, where our first regional competition would take place about a month later.

The Competition: The competition began with five practice rounds per team. We made minor changes between rounds to take care of potential problems. Meanwhile, our scouts recorded information about the capabilities of other teams in order to develop winning strategies.

Qualifying rounds began the next day. We enjoyed the lead for a while, but fell to eighth place by the end of the day. On the final day, each of the top eight teams chose two other teams to join their alliance for the elimination rounds. By the time it was our turn to pick, the choices were limited, but we were able to pick two solid teams as our partners.

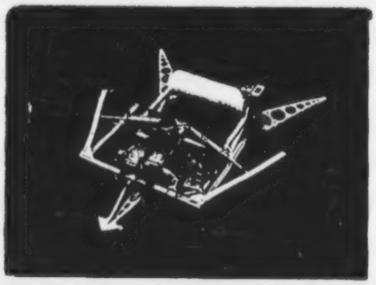
The elimination rounds were in a best-of-three format. Our opponents in the first round included an excellent ball-handler and a goal-grabbing robot. By blocking the ball handler and gaining control of the goals, we were able to win the round in two straight matches. In our semifinal round, we gained control of the goals early in each match, but our opponents later managed to steal them. We lost in two straight matches and were eliminated. However, we were proud to receive the Xerox Creativity Award for the design of our robot.

I was disappointed that we did not do as well as we did during my freshman year, in which we won both of the regional competitions we attended. But FIRST Robotics is about more than winning. It is a learning experience. Much of what I have learned, from managing time effectively to solving problems quickly to working hard and well under pressure, will serve me well not only in next year's competition, but in many of my endeavors beyond robotics. ■

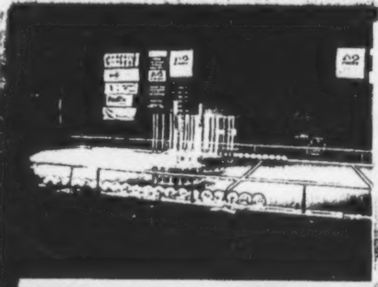
Ameya Agaskar **is a junior at Hopewell Valley Central High School in Pennington, N.J. In addition to robotics, he participates in Model U.N., debate, Mock Trial, Math League, and Science Bowl. He plays piano, viola, and violin and volunteers at Recording for the Blind and Dyslexic.**

For more information about the FIRST Robotics Competition, see www.usfirst.org or call (603) 666-3906. See page 14 for information about LEGO League, a FIRST program for middle-school students.

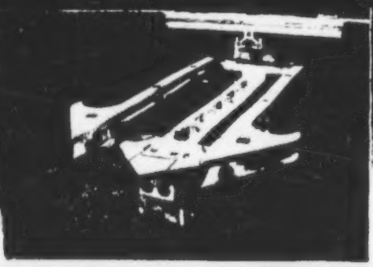
Members of Ameya's team make adjustments to the robot.



The final robot in all its glory. Note the ball roller in the front, the goal-grabbing arms on the side, and the Sickle of Death on the back.



The pristine playing field. Robots earn points by placing balls in the goals (center) and moving them to different positions on the field.



The Sickle of Death in goal-moving position.

Fun for All!

FIRST LEGO League

FIRST LEGO League (FLL) challenges teams of students ages 9–14 to design, program, and build autonomous robots using LEGO Mindstorms™ Robotic Invention System. The annual Challenge is announced in September; competitions begin in November. In the 2001 Challenge, called Arctic Impact, robots earned points for saving scientists, instruments, and data—all tasks completed on a nine-station competition table.

To get a participant's perspective of this competition, we asked three students from different teams about their FLL experiences. If you want to learn more, visit www.usfirst.org/jrobtcs/

Katharine Flaherty, Grade 6
Team #538: Ice Fragments
Culpeper, VA

Number of years participating in FLL: Three.

Description of your team's robot: We named our robot Ice Force One after the President's plane, only for the Arctic. The robot is small and compact and has a somewhat large arm.

Favorite LEGO League moment: Our team completely erupted when we earned 320 points in one round—only 20 points below the highest possible score. We were jumping all over each other.

Advice to prospective LEGO Leaguers: FLL is fun, but it takes a while to learn. The most important thing is teamwork.

Nick Levesque, Grade 8
Team #1612: S.H.E.B.A. Amoeba
Weare, NH

Number of years participating in FLL: Two. This year I was our team co-captain.

Description of your team's robot: The main unit had two big rubber tires on the back for traction and two plastic tooth gears on the front so it could turn easily. Our robot had several detachable "arms," including a trailer, a plow, and a slide like a conveyor belt, that we took on and off during the competition rounds. Some attachments were multipurpose so we didn't lose valuable time taking them off.

Favorite LEGO League moment: I enjoyed the whole experience because I got to work with a lot of different people and learn a lot of new things about technology. It was rewarding to see our robot really work in competition.

Advice to prospective LEGO Leaguers: I would encourage anyone who's interested in technology and robotics to experience FIRST LEGO League firsthand. Get some friends together and start a team.

Gabe Garcia, Grade 6
Team #15: Robomasters
San Jose, CA

Number of years participating in FLL: Two years as a team member, this year I'm mentoring my brother's 4th-grade team.

Description of your team's robot: Our first-year robot [designed to rescue a stranded astronaut] had two prongs out front to drop oxygen balls to astronauts and a hook on the back to release the astronauts to the tank. Our second-year robot had a skid and a bumper designed to push a gate closed and drop a bridge. It also had two prongs in front for carrying instruments.

Favorite LEGO League moment: This year, when I was mentoring my brother's team, they were in 13th place and had to get 9th or better to make the play-off finals. They were psyched and the last team to play. They did really well that round. When the scores came up, they were still in 13th, but we were all excited about how the robot did and were proud to have made it to that point.

Advice to prospective LEGO Leaguers: Don't give up. Don't be too upset if your robot doesn't function properly—robots sometimes turn the wrong way, and the gears come apart, too. Don't get frustrated, just fix it. ■

ADVENTURES IN ROBOTICS

by Hans Anderson

Above my workbench is a menagerie of robots I've made. As I sit here working on my latest project, I look up and remember the glory that my robots and I have shared...

When I was eleven years old, I took a course in robotics at the Rocky Mountain Talent Search Summer Institute. There, I built my very first robot from a kit. I was so inspired that I came home eager to build another—and design it myself.

I wanted it to fight small plastic soldiers, so I gave it a weapon: a fan to blow the soldiers away (or at least over). The control system included a photocell, a sensor that responds to changes in illumination. At the time, I did not know the operating conditions for a photocell, so I went online to radioshack.com to find out. The tables were poorly labeled, and I mistook the table listing the maximum power rating for one indicating the minimum amount of power needed to run the component. I almost took the parts back because I thought they needed over 100 volts to activate them. But with a dash of hope, I tried to run it using only a nine-volt battery and it worked. Victory!

Excited by my success, I designed another robot to pull my first robot through armies of plastic soldiers. But it was not just a transport device. It was also a weapon that delivered a mighty one-volt electric shock. I lost many hours of sleep imagining different designs for it.

This robot has a special place in my heart because it's the only one I've taken on tour. That summer, my parents and I visited relatives in Boston, and I brought the robot along. We arranged to visit several professors at MIT and Harvard, and my robot met many people and rolled across numerous desks and floors. One post-doc we met was extremely interested in the robot and wanted to see its design schematics. Despite the honor bestowed on it by our gracious hosts, it was not always well behaved. At Harvard, its screws gashed my hand, and at MIT, a good portion of its belt drive system broke off. But even with these mishaps, we had a great time.

After my success on the ground, I turned my attention to the sky, to programmable rockets I could launch into space. My first idea was to launch a heat sensor in the payload of a rocket, to record data about the sun. Wisely, a well-intentioned friend did not allow me to use his launch pad. Between the rocket's flammable batteries and the sensor's explosive payload, it could have blown up his launch pad.

Undeterred, I pressed on. I was intent upon sending a solar sensor up in the payload of a rocket. But before doing that, I decided I should check whether the rocket was safe to use with an important payload. I was concerned that the rocket's vibrations would loosen or break a solar sensor's electronics. So I built a very simple vibrational sensor: just an LED, a switch, and a power source. As long as the circuit was intact, the LED's light would stay on.

On this project, my younger brother got involved, too. We launched the rocket and sensor from our own launch pad—or at least we tried to. When we got to the launch site, the launch lug, which attaches the rocket to the launcher, fell off. I did not want to walk home for glue, so I taped it together. That was a mistake. When we launched the rocket, instead of going up, it fell over. The now flaming engine started a roaring grass fire in the meadow as we stood there and watched the flames in awe. My brother came to the forest's rescue with a water bottle. Meanwhile, the payload flew about a meter into the air, then crashed. After we extinguished the engine fire, we went to see what happened to the sensor. Miraculously, the LED was still lit. I am not going to launch anything worthwhile in that rocket.

My adventures in robotics have taught me many things. One of the most important is that, no matter how many hours of sleep you lose thinking about them, your robots will rarely work the way you think they will. That's part of the fun of robotics, and the frustration. But no matter what happens, you are guaranteed to have adventures. Just be sure to keep a First Aid kit and a fire extinguisher nearby.

A resident of Evergreen, CO, *Hans Anderson* took a Logic Programming course when he was nine. Now thirteen, he is taking his third electronics course at Arapahoe Community College. He enjoys building robots, programming, and playing video games.

Building a Better

INTERVIEW WITH
DR. JASON DANTE BARDIS

by: Michelle Federico

BattleBots, a Comedy Central series, features contestants who design and build radio-controlled robots to face off against one another in three-minute bouts of pure robot combat. These "bots" utilize a variety of tactics such as flipping arms, wedges, spinning discs, spikes, and hammers to defeat their opponents, while steering clear of the various hazards and obstacles in the battle arena. We asked Dr. Jason Dante Bardis, an experienced BattleBots competitor, how he got into robot combat and why he keeps coming back for more.

What exactly does a BattleBots competitor do?

Quite a bit, actually. You have to dream up an idea for beating other bots, which usually involves thorough TV and Web research of competitors' bots. Then, you have to figure out how to make your dream real and set aside copious amounts of time and money for the project.

Making parts and assembling the bot takes most of your time. You usually see a lot less of your family and friends. In the process of building, you'll inevitably need to go through several redesigns and rethink some parts (something or other is bound not to work out perfectly the first time around).

You should practice driving your robot, even though half of the new competitors don't. Most fights seem to come down to driving skill. Practice will not only improve your technique, but also identify weaknesses in your bot before the competition.

Once at the competition, you will most likely discover that your bot is overweight when weighed on the official scale. A drill or file comes in handy to remove some material, and you'll quickly identify and remove any redundant fasteners or parts, just to make weight. While fighting, you must keep cool in front of the crowd and cameras.

After competing, you start tearing down the bot to get it ready for the next BattleBots competition. The sooner you start rebuilding, the less of a crunch you'll be in when the next event rolls around.

1.1L
Dr. Inferno Jr.

Dr. Inferno Jr. in the BattleBots arena. You can get your own Dr. Inferno Jr. toy in Fall 2002 from Tiger Electronics.

©2002 BattleBots Inc.
Daniel Longmire, Photographer

When and how did you first become interested in robotics?

I grew up playing with toys that led to my later love of robotics: LEGO, Erector sets, Lincoln Logs, Hot Wheels, Zoids, slot cars, remote control cars, model kits, video games, and home computers. Later, when I was in school, I was interested in and good at physics and math, which combined perfectly with my childhood interests. Robotics has it all for me: design, mechanics, remote control, some math and physics, and it's also an excellent creative and artistic outlet.

I first saw robot combat in *Wired* magazine in 1993, but I didn't have the resources or the time to enter a competition until 1996. My first fighting robot was awful, but I learned so much and I had so much fun anyway.

BattleBot

Jason Dante Bardis and his robot Dr. Inferno Jr., the BattleBots season 3.0 lightweight champion and season 4.0 lightweight rumble champion.

© 2002 BattleBots Inc.
niel Longmire, Photographer

What kinds of robots have you created?

Most of my robots are mean; their mission in life is to destroy other bots. I've built about nine fighting robots since 1996.

My least violent bots were Itchy and Scratchy, designed for the LEGO booth at the 2001 E3 trade show. They were supposed to gather Ping-Pong balls and bring them to one side of the arena. Instead, I designed them to kick the balls into the audience or slam down on them to crush them. These were the least violent because I designed them to beat up on Ping-Pong balls rather than other bots.

How do you decide what kinds of robots to create?

I have two main goals when creating a fighting bot: combat superiority and aesthetic appeal. It's difficult to build a robot that can achieve both. Winning bots tend to be boxy and efficient, and lack character, while aesthetically appealing bots tend to be more fragile and less efficient. For example, I made Towering Inferno completely wacky and different from any other BattleBot, but the tougher part has been getting him to be a good fighter, too—he's got a 2-2 record.

Sometimes it just happens by chance. I built one of my bots, Dr. Inferno, out of an old toy robot as a joke, and he actually got third place at BotBash, against much heavier robots. So I thought it would be fun to kick that idea up a notch and make a sequel, but make it a serious contender. Dr. Inferno Jr. was born.

What are you working on now?

I'm in the midst of several robot projects right now. I'm updating three of my bots—Dr. Inferno Jr., Towering Inferno, and Hell on Wheels—to make them more robust and competitive. I also just built two LEGO Mindstorms bots, The Infernal Brick of Despair and Longneck, for a tug-of-war competition, and a remote-controlled LEGO Mindstorms bot for the Robotics Society of America Sumo and Robot Expo.

What advice can you give to young people who are interested in robotics?

Anybody can do this! Don't be intimidated. There are so many kits, books, tutorials, and toys out there that let people get their feet wet with minimal time and money invested. My personal favorite is LEGO Mindstorms, although $200 may seem steep for a toy. But to me, it's not just a toy—it's also a valuable design and engineering tool. I even built a motorized prototype of Towering Inferno out of LEGOs before cutting the first piece of metal to build the real bot.

When you're ready to build a BattleBot, remember to start small (cost goes up with size and weight), learn about the designing and building processes, and then ramp up to bigger machines. And, who knows, maybe I'll see you on BattleBots!

Jason Dante Bardis earned a Ph.D. in mechanical engineering from the University of California–Santa Barbara on Valentine's Day 2002. He has competed in 14 robot competitions with over a dozen bots since 1996. He will be returning to BattleBots for season 5.0 in San Francisco in May 2002 with upgraded versions of his current high-ranked bots, Dr. Inferno Jr. and Towering Inferno. To learn more about Jason and his bots, visit the Web site for his robotics company at www.infernolab.com

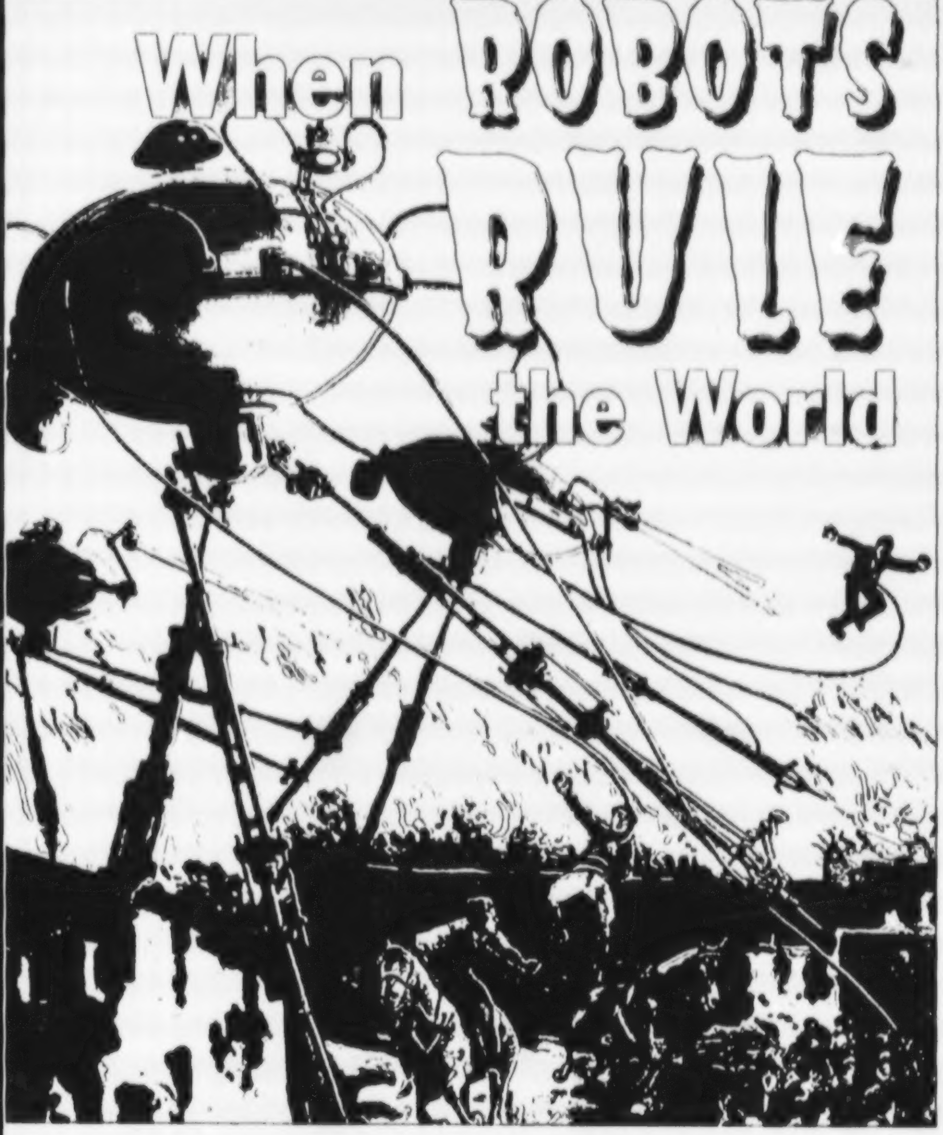
BattleBots IQ

BattleBots IQ is a new educational program where students ages 12–18 learn about engineering by creating a competitive BattleBot. The curriculum, which incorporates mathematics, physics, and engineering, is typically offered as a one- or two-year course at middle and high schools or at qualified youth organizations such as Boy Scouts or Girl Scouts.

As a way of further applying their skills in design, team building, budgeting, and constructing, teams enter their robots in the BattleBots IQ tournament.

Visit www.battlebotsiq.com to learn more about BattleBots IQ. To find out how to get your school or youth organization involved in BattleBots IQ, e-mail Nola Garcia, National Education Director, at nola@battlebots.com

When ROBOTS RULE the World



by Carol Blackburn

We love mean machines, from the Terminator to the Borg to BattleBots. We are strangely drawn to these cyberwarriors who feel no fear or pain or pity or remorse. They don't yet roam the streets, but already they wander our dreams.

We know intelligent machines are coming, and we can't help wondering about the world they will usher in. Of course, not all the intelligent machines we envision are mean. Most will make life infinitely better. That's part of what makes them so irresistible—there's so much promise as well as peril in this technology.

Science fiction is part of a larger conversation about our future and the role intelligent technology will play in it. One of the core questions in this discussion is what the ultimate goals of technological advancement should be. Inventor Ray Kurzweil has made the pointed comment, "I do believe that we have the ability to shape this destiny to reflect our human values, if only we could achieve a consensus on what those are." Millennia of human history have not created consensus. Technological progress may force the issue.

We have time to consider our answer. Fast as things are happening, we're still a long way from *The Terminator*. Rodney Brooks, director of MIT's AI Laboratory, assures, "We're not going to build robots that all of a sudden can be so smart that they can take over the world. We're going to decide when we don't like uppity robots and we'll put controls in them."

The discussion is already well underway. Here are a few snatches from this fascinating, profound, mind-expanding conversation, from researchers in the forefronts of their fields. Listen, ponder, join in.

The future is not set. Help shape it.

J. Storrs Hall, Research Fellow, Institute for Molecular Manufacturing

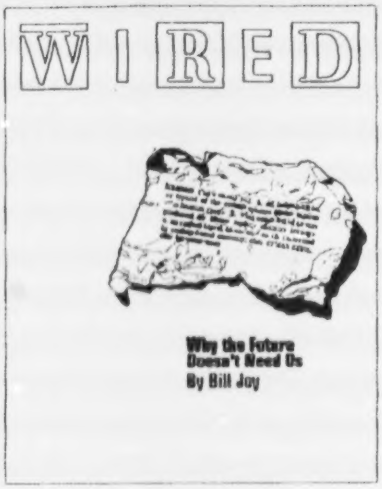
"We have in the past been so complacent in our direct control of our machines that we have not thought to build them with consciences (visionaries like Asimov to the contrary notwithstanding). We may be on the cusp of a crisis as machines grow in power but not in moral wisdom....

"There has always been a vein of Frankenphobia in science fiction and futuristic thought.... Such fear is eminently justified against the prospect of machines more powerful than we are, without consciences. Indeed, on the face of it, building superhuman sociopaths is a blatantly stupid thing to do.

"Suppose, instead, we can build (or become) machines that can not only run faster, jump higher, and dive deeper, but have moral senses similarly more capable?... A society that includes superethical machines would not only be better for people to live in, but stronger and more dynamic than ours is today.

"The inescapable conclusion is that not only should we give consciences to our machines where we can, but if we can indeed create machines that exceed us in the moral as well as the intellectual dimensions, we are bound to do so.... [Everything we care about will be] better cared for by, *more valued by*, our moral superiors whom we have this opportunity to bring into being. It is the height of arrogance to assume that we are the final word in goodness. Our machines will be better than us, and we will be better for having created them."

Excerpted from "Ethics for Machines" by J. Storrs Hall (2000, http://discuss.foresight.org/~josh/ethics.html). He is currently expanding this essay into a book.



Bill Joy, Co-Founder and Chief Scientist, Sun Microsystems

"Now, as then [the Manhattan Project], we are creators of new technologies and stars of the imagined future, driven—this time by great financial rewards and global competition—despite the clear dangers, hardly evaluating what it might be like to try to live in a world that is the realistic outcome of what we are creating and imagining.... Given the incredible power of these technologies, shouldn't we be asking how we can best coexist with them? And if our own extinction is a likely, or even possible, outcome of our technological development, shouldn't we proceed with great caution?...

"One would think that we might be driven to such a dialogue by our instinct for self-preservation. Individuals clearly have this desire, yet as a species our behavior seems to be not in our favor.... If we could agree, as a species, what we wanted, where we were headed, and why, then we could make our future much less dangerous.... As Thoreau said, 'We do not ride upon the railroad; it rides upon us'; and this is what we must fight, in our time. The question is, indeed, Which is to be master? Will we survive our technologies?"

*Excerpted from "Why the Future Doesn't Need Us" by Bill Joy (**Wired**, April 2000). He is currently expanding this essay into a book.*

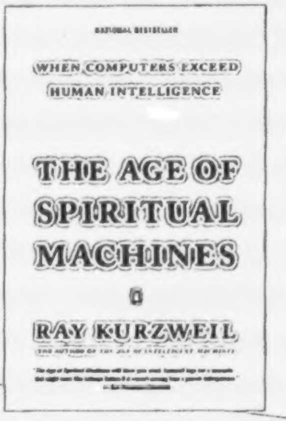
Ray Kurzweil, Inventor

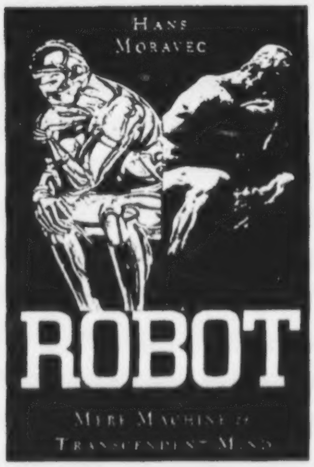
"The process of automation... eliminates jobs at the bottom of the skill ladder and creates new ones at the top. Hence increasing investment in education. But what happens when the skill ladder extends beyond the abilities of the bulk of the human population, and ultimately beyond the ability of any human, educational innovations notwithstanding?... The only way for the species to keep pace will be for humans to gain greater competence from the computational technology we have created, that is, for the species to merge with its technology....

"We are in the early stages of a deep merger between the biological and nonbiological world.... I regard the freeing of the human mind from its severe physical limitations of scope and duration as the necessary next step in evolution. Evolution, in my view, represents the purpose of life. That is, the purpose of life—and of our lives—is to evolve.

"What does it mean to evolve? Evolution moves toward greater complexity, greater elegance, greater knowledge, greater intelligence, greater beauty, greater creativity, and more of other abstract and subtle attributes such as love. And God has been called all these things, only without any limitation.... So evolution moves inexorably closer to our conception of God, albeit never quite reaching this ideal. Thus the freeing of our thinking from the severe limitations of its biological form may be regarded as an essentially spiritual quest."

*Excerpted from **The Age of Spiritual Machines: When Computers Exceed Human Intelligence** (Viking Penguin, 1999), and KurzweilAI.net by Ray Kurzweil.*





Hans Moravec, Founder, Carnegie Mellon University's Robotics Institute

"Barring cataclysms, I consider the development of intelligent machines a near-term inevitability.... Each advance will provide intellectual rewards, competitive advantages, and increased wealth and options of all kinds. Each can make the world a nicer place to live. At the same time, by performing better and cheaper, the robots will displace humans from essential roles. Rather quickly, they could displace us from existence. I'm not as alarmed as many by the latter possibility, since I consider these future machines our progeny, 'mind children' built in our image and likeness, ourselves in more potent form. Like biological children of previous generations, they will embody humanity's best chance for a long-term future. It behooves us to give them every advantage and to bow out when we can no longer contribute.

"As also with biological children, we can probably arrange for a comfortable retirement before we fade away. Some biological children can be convinced to care for elderly parents. Similarly, 'tame' super intelligences could be created and induced to protect and support us, for a while. Such relationships require advance planning and diligent maintenance.... It is the 'wild' intelligences, however, those beyond our constraints, to whom the future belongs."

*Excerpted from **Robot: Mere Machine to Transcendent Mind** by Hans Moravec (Oxford University Press, 1999).*

For more on this topic, see:
cty.jhu.edu/imagine/links_95.htm

Bot Bits

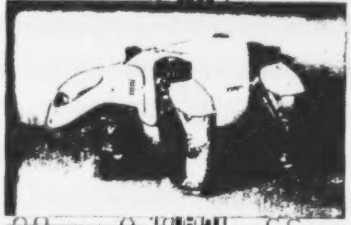
Robots in the Headlines

by Michelle Federico

Robots were first introduced to the world by writers such as Karel Capek and Isaac Asimov. Viewed as figments of the authors' imaginations, robots were not taken too seriously in those early days. But today, robots are very much a part of our society, and they serve humans in many ways. Besides providing entertainment, today's robots are also performing tasks that require too much precision or are too dangerous, repetitive, or costly for humans to perform. The photos on these pages show some recent advances in robotics, and hint at how much further we can still go.

Taking Flight
SoloTrek XFV, a one-person flying machine designed and built by Millennium Jet, is currently undergoing flight testing. The pilot stands upright on the machine as two powerful counter-rotating fans provide propulsion. Using hand controls, the pilot commands the aircraft to take off vertically, fly horizontally at speeds up to 80 miles per hour, and then land vertically again on a small clear patch of ground. SoloTrek XFV is expected to fly at altitudes up to 2,400 meters and to carry up to 350 pounds.

Photo: ©2000, 2001, 2002 Millenium Jet, Inc. All Rights Reserved



Burglars Beware
Sanyo Electric Co. and Tmsuk, Inc., have created a four-legged walking robot, named T7S, to guard homes against intruders. The voice-controlled robot can detect abnormal lights and send images taken with its camera to the cell phone of its owner. T7S will be available in two versions. Type 1 can climb small steps, but it can only walk about 25 meters per minute; Type 2 can walk about 35 meters per minute. Production of T7S should begin next year.

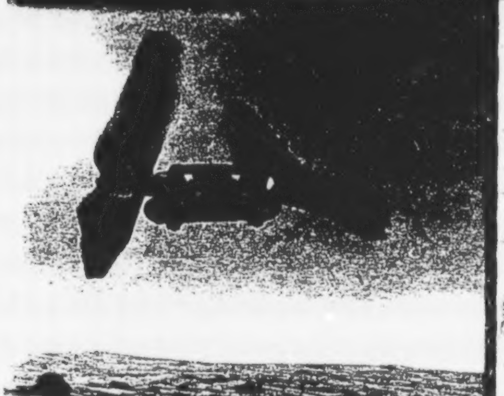
Photo: Tmsuk, Inc.

Lobster Scents
A robotic lobster is being used to study how real lobsters can follow chemical trails, a process known as plume tracing. Using flourescent dye (illuminated by a sheet of red laser light), high-speed video, and a computer-controlled steel wire, researchers at Stanford, UC–Berkeley, and Bowling Green State modeled the flow of a plume past the robotic lobster's antennules. An artificial plume-tracing system could be used to locate landmines or underwater explosives.

Photo courtesy of Megan Wiley, Jeffrey Koseff and Mimi Koehl

That's Entertainment
Sony's new walking robot, SDR-4X, is designed to interact with people in their homes. SDR-4X can walk on almost any surface, carry on simple conversations, dodge obstacles in its path, recognize color, dance, and even sing if programmed with music and lyrics. By utilizing two cameras and seven microphones, the robot can also be programmed to recognize ten people by their faces and voices. SDR-4X will be sold later this year for as much as a luxury car.

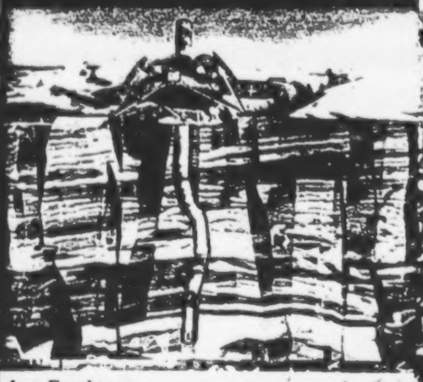
Photo: AP/Wide World Photos



To Mars and Back

Developed by a team of researchers at Georgia Tech, University of Cambridge, and ETS Labs, a flapping-winged robotic insect called Entomopter may be ideal for Mars aerial exploration. Mars's atmosphere is so thin that conventional aircraft would have to fly at least 250 miles per hour to generate enough lift to stay aloft. Entomopter's flapping wings allow it to generate lift by moving only its wings rapidly, while its body flies slowly. Its flapping wings also allow it to land and take off, quickly change directions, and hover.

Photo: ©2001 Georgia Tech Research Institute



Ice Explorer

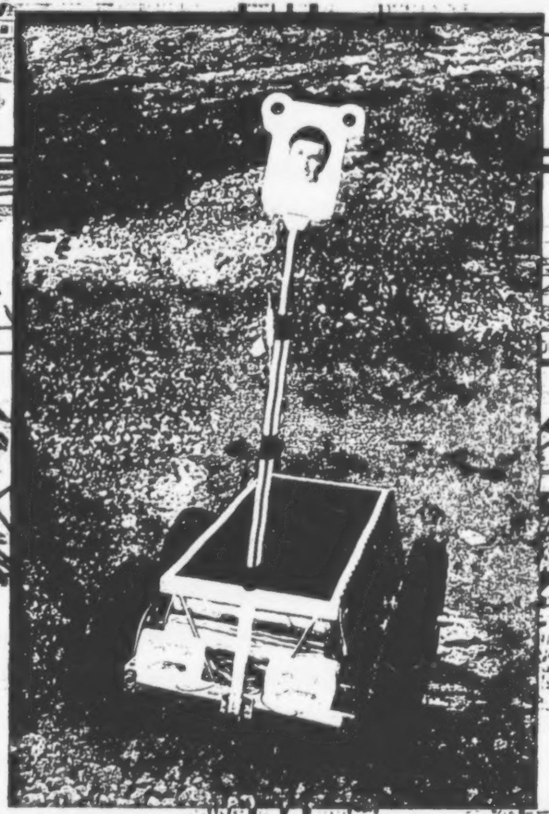
Cryobot, a NASA robot designed to melt through layers of ice, has undergone its first successful test in the Arctic. Originally created to explore beneath the surface of Jupiter's moon Europa, the robot could also delve into the polar ice caps of Mars or unexplored expanses of ice on Earth. Cryobot melts the ice directly in front of it, while allowing the liquid to flow around the cylinder and refreeze behind it. It takes measurements of the encountered environment and sends the collected data to the surface.

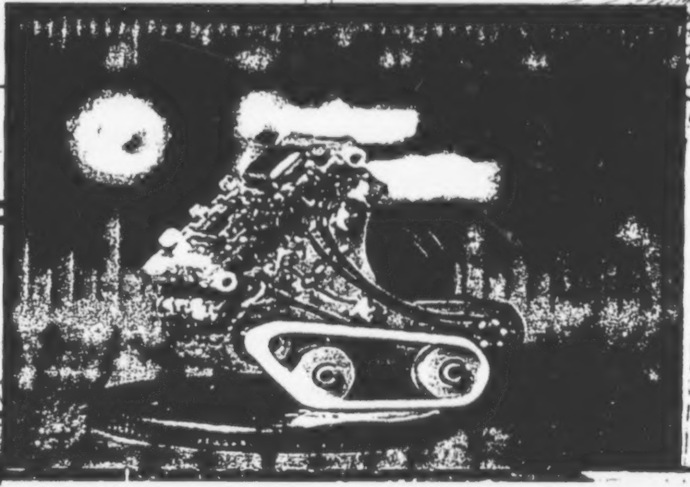
Photo: © NASA JPL

Robotic Newshound

The Afghan Explorer, a telepresence robot being built at the MIT Media Lab, could improve reporting capabilities in environments hostile or off-limits to human reporters. Remotely controlled via a personal computer and a Web browser, the Explorer is able to operate nearly anywhere in the world, and can cover tough terrain. A Web camera could even provide two-way videoconferencing. The solar-powered robot is 3 feet long and 2 feet wide, and can travel 30-40 miles a day. MIT plans to send the Explorer to Afghanistan for a test run.

Photo courtesy of Chris Csikszentmihalyi, MIT Media Lab





A Small World

Possibly the world's smallest robot is being developed at the Department of Energy's Sandia National Laboratories. Measuring 1/4 cubic inch and weighing less than an ounce, these microrobots could detect chemical and biological weapons or landmines that are planted in locations too small for today's larger robots, or they could work together in swarms. Powered by three watch batteries, they consist of an 8K ROM processor, temperature sensor, and two motors that drive the wheels. Potential enhancements include a miniature camera, microphone, communication device, and chemical microsensor.

Photo courtesy of Sandia National Laboratories

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A HELPING Hand

by Carol Blackburn

Photo courtesy of Intel Corp.

It started so simply—waiting in line at a fast food restaurant, something he had done a thousand times before. But that day, something clicked. That day, Ryan Patterson saw a group of hearing-impaired customers struggling to make themselves understood to the cashier, and it struck him how useful it would be for them to have a device that could convert sign language into written or spoken words. An idea was born.

Over the next few months, Ryan developed a prototype of a glove that translates American Sign Language finger-spelling to text and displays it on a small portable device that can easily be carried in a purse or backpack. Nine months after he began work on it, while still a high school junior, he won the highest prize at the 2001 International Science & Engineering Fair: an invitation to attend the 2001 Nobel Prize awards ceremony. The next year, he went on to win first prize at both of the national science fair competitions open only to seniors: the Siemens Westinghouse Science & Technology Competition and the Intel Science Talent Search. All from a simple idea.

Hand in Glove

Ryan built his sign-language translator from scratch, for less than $200. He started with a golf glove and attached ten small sensors to it in such a way that bending a finger changes the resistance in nearby sensors. The resistance of all ten sensors is read and digitized by a small circuit board on the back of the glove. "There's a small microcontroller on board, too," Ryan explains, "and it packages the information and transmits it over a wireless link to either a computer or the portable display device." The wireless link makes it very convenient to use.

Before the computer can interpret the signals from the glove and translate them into letters, it must be "trained" to recognize the way an individual user signs. Ryan built the training program from scratch, too, writing all the necessary software. "During training, each letter is displayed on the computer screen, and the program uses pattern-matching algorithms to learn to recognize how you sign each letter. Once the training is complete, you can download it to the portable display to take with you."

Not only can the computer print out signed letters, it can also "speak" the words they create. "That was a feature the potential users I spoke to said they wanted," Ryan says. "So I included a voice translation and dictation system: a human voice speaks what you're signing."

Though he has a patent pending on his glove, Ryan is still improving it. "I'm actually redeveloping the entire product now before it hits the market, incorporating some new types of electronics that are more versatile and portable." It's an idea that just keeps getting better.

Laying the Groundwork

Of course, the story really started years before that day in the restaurant. "I was very curious about electronics from the time I could walk," Ryan recalls. "And my parents couldn't answer my questions after about first grade." By the time he was in third grade, he was stumping his teachers, too, so they went looking for a mentor. They found John McConnell, a physicist who had recently retired from Los Alamos National Lab and was doing some volunteer work with the school district.

"I started going to his house every Saturday for the whole day, and he taught me the basics—reading schematics, building circuit boards, and working with different components." By freshman year, Ryan had learned everything McConnell had to teach him and was working on his own. "But we still talk almost every day. He and his wife are like grandparents. And they help when they can. Mrs. McConnell sewed the little pockets for the sensors onto the glove," Ryan says with a smile.

Their relationship has had a profound effect not only on Ryan but also on McConnell. Working with Ryan was so inspiring that McConnell decided—at the age of 68—to start a science education center. "He wants to try to reach as many children as possible, so he's started the Western Colorado Math & Science Center. It has all sorts of displays and demonstrations and stuff about physics. More than a thousand kids go through it every month."

And attending the Nobel Prize ceremony? What was that like? "It was great—the best week I've ever had." Ryan met Nobel laureates past and present and toured Stockholm with other young scientists selected to attend the ceremonies. "It was an exciting experience culturally as well as scientifically because it was my first time overseas. The only bad thing was that the pre-awards events started the last day of the Siemens competition. The other students got there a day or two before I did, and they got to meet the Swedish princess. I missed out on that. But it was still incredibly exciting."

Next time an idea strikes you, you may want to pursue it. It might not take you all the way to Sweden, and you probably won't meet a princess, but you may accomplish more than you imagined. And you never know how many lives your work may touch. ■

Intel Science Talent Search (STS)

Now in its 61st year, the STS is the nation's most prestigious precollege science competition. Open only to high school seniors, the STS awards college scholarships to the 40 contestants chosen as finalists. First-, second-, and third-place winners receive $100,000, $75,000, and $50,000, respectively. Fourth- through sixth-place winners each receive $25,000. Seventh- through tenth-place winners each receive $20,000. The remaining 30 finalists each receive $5,000. Each finalist also receives a high-performance Intel-processor-based mobile computer.

This year's top Intel STS winners were:

1. **Ryan Patterson**, 18, of Grand Junction, CO.
2. **Jacob Licht**, 17, of West Hartford, CT.
3. **Emily Riehl**, 17, of Bloomington, IN.

For more about the Intel STS, see:
www.sciserv.org/sts/

Intel International Science & Engineering Fair (ISEF)

Founded in 1950, the ISEF is the world's largest precollege science competition, bringing together over a thousand students in grades 9–12 from around the world. Two individual winners and one winning team from each regional ISEF-affiliated science fair are invited to attend the ISEF. Prizes are awarded in 14 scientific disciplines and include scholarships, internships, scientific field trips, and the grand prize: an invitation to attend the Nobel Prize awards ceremony in Stockholm, Sweden.

This year's top ISEF winners were:

Alexander Mittal, 17, of Greenwich, CT,
Naveen Neil Sinha, 17, of Los Alamos, NM, and
Nina Vasan, 18, of Parkersburg, WV.

For more about the Intel ISEF, see:
www.sciserv.org/isef/

Siemens Westinghouse Science & Technology Competition (SWSTC)

Now in its fourth year, the SWSTC awards scholarships to high school seniors, recognizing both individual and team efforts in science and technology. The top individual receives $100,000 and the winning team shares $100,000.

This year's top SWSTC winners were:

Individual: **Ryan Patterson**, of Grand Junction, CO.
Team: **Shira Billet** and **Dora Sosnowik** of Hewlett Park Bay, NY.

For more about the SWSTC, see:
www.siemens-foundation.org

EXPEDITION

THE YOUNG NATURALIST AWARDS

If you love the beach, the mountains, or the wildlife in your part of the world, there's a contest waiting to challenge you: The Young Naturalist Awards. Created by the American Museum of Natural History, this program encourages students in grades 7–12 to undertake explorations in biology, earth science, or astronomy, and then to share their findings effectively in writing.

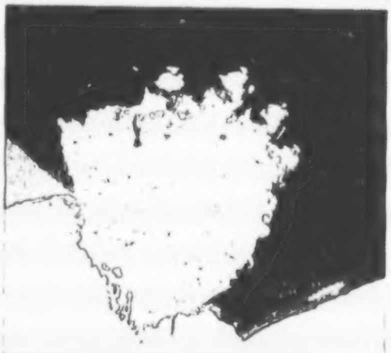
The following articles are excerpts of two of the twelve winning 2001 essays. To read these and the other winning entries in their entirety—and to find out how you can enter the contest next year—visit www.amnh.org/nationalcenter/youngnaturalistawards/

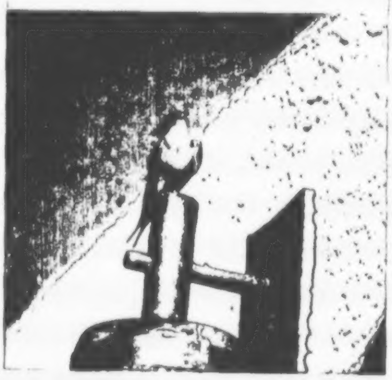
NESTING HABITS OF THE BARN SWALLOW

by Elspeth Iralu

On December 31, 2000, I went on an expedition up a ladder to examine two barn swallow nests. The nests are right outside my front door, on opposite corners of my family's front porch, here in Gallup, New Mexico. My original plan was to take the nests apart to see what items the swallows had used. But earlier in December, when I started to read about barn swallows, I learned how much work is put into the nests, and I decided not to take the nests apart. Instead, I examined them from a ladder.

Materials used in the first nest included mud and straw. I also saw a hair or nylon thread woven into the nest. The second nest was made of mud, straw, and pebbles. I removed some additional material from the nest, which I later identified as two-pound fishing line, eight-pound fishing line, and nylon broom material. Both nests were filled with straw and feathers, for bedding. The second nest I examined was almost overflowing with feathers! Even though I knew that barn swallows line their nests with feathers, I had expected that wind, snow, and rain would have blown all the feathers away. I now know why the barn swallows chose the top of our front porch for their home: It is very protected.





Photos by Elspeth Iralu

Each year, by late March or April, a pair of barn swallows arrives at our front porch. They always spend a few days fixing up the nest that is their summer home. This past summer, though, the barn swallows decided that they wanted a new nest and started to build it in a corner of our porch that is directly above our front door.

It took the swallows about a week to complete the nest, and soon after they had settled in, another pair came. These swallows fixed up the old nest and took up residence there. This past summer, both couples raised three sets of young. Watching the adult swallows feed their young was very interesting because they were not shy of us. Even though we couldn't see what the parents were feeding their young, we could clearly see the wide, hungry beaks of the young as their parents deposited food in their beaks.

We have also observed a quirky animal behavior. One day, my dad turned on a world-beat CD that opened with a flamenco guitar song. With the front door open, the barn swallows could hear the music; they got excited and started flying up and down and in circles around our driveway and front porch. We use our CD player throughout the day, and no one in the family had ever observed them responding to music before, so we were surprised. Now, from time to time, we turn on that CD, The Best of World Music, just to see the barn swallows "dance."

Recently, I read that barn swallows migrate as far south as Argentina during the winter. Perhaps our visitors recognized the flamenco guitar as music that they hear during the winter and felt that they were indeed at home.

Next spring, we will encourage the barn swallows to nest as they please. I

STORIES

have even learned of some ways to help the barn swallows, such as setting out a tray of mud to make nest repair easier on the birds, and setting up a birdbath with sticks over the top of the bowl to protect the birds from frostbite. I am looking forward greatly to the spring arrival of the swallows. ■

Elspeth Iralu is a homeschooled ninth grader. A member of *Imagine*'s Readers Panel, Elspeth enjoys ballet, nature photography, and playing classical piano.

A DAY AT THE (BARRIER) BEACH: MY EXPEDITION TO SANDY HOOK

by Madeline Kunsberg

Last June, I eagerly joined an expedition to Sandy Hook sponsored by the New Jersey Marine Science Consortium. At the rendezvous point, Building #205, Fort Hancock, Sandy Hook, I met the other members of my team, three Brookdale Community College students. I also met Bob, a one-legged lab technician with a colorful past as a lobster fisherman. He detailed our expedition plan: two teams of students would visit Plum Island and the Critical Zone, locations on Sandy Hook, record observations about the physical patterns of this barrier island, and take water samples from both the Atlantic Ocean and the Sandy Hook Bay.

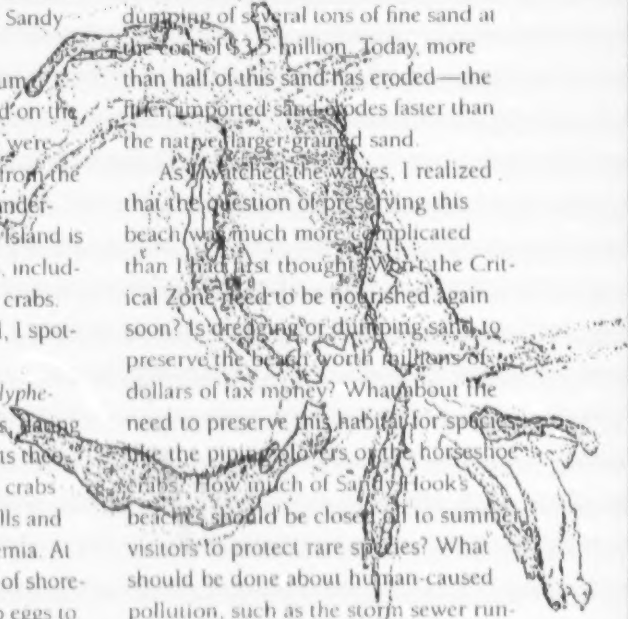
My team of four set off to Plum Island, a freshwater tidal wetland on the bay side. The others in my team were content to observe Plum Island from the road, but I waded through the undergrowth in search of crabs. Plum Island is a haven for many marsh species, including blue, fiddler, and horseshoe crabs. Knee-deep in some sort of weed, I spotted a horseshoe crab.

Horseshoe crabs, *Limulus polyphemus*, are considered living fossils, dating back to the Triassic era. Scientists theorize that the blood of horseshoe crabs inhibits the growth of cancer cells and may be useful as a test for leukemia. At Sandy Hook in May, thousands of shorebirds depend on horseshoe crab eggs to replenish their fat supply before leaving for arctic breeding grounds. If horseshoe crabs become endangered, possibly due to pollution in the bay, a decrease in the population of the crabs—and consequently of the shorebirds—would upset the ecological cycle.

My nature walk was interrupted when my teammates shouted at me to stop fooling around in the poison ivy. I extricated myself from the vines and hurried back. Fortunately, I was wearing jeans.

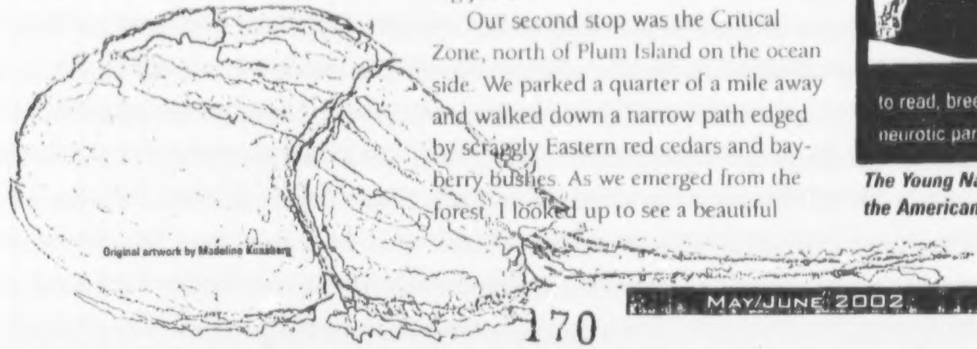
Our second stop was the Critical Zone, north of Plum Island on the ocean side. We parked a quarter of a mile away and walked down a narrow path edged by scraggly Eastern red cedars and bayberry bushes. As we emerged from the forest, I looked up to see a beautiful beach and a deep blue ocean with a view of New York. White mottled birds, piping plovers, screamed and soared in circles above us. The Critical Zone is one of the few remaining nesting habitats for the plovers, and their nesting areas are marked off to protect the birds from human traffic.

The Critical Zone beach was named in 1997 when it was "nourished" by the dumping of several tons of fine sand at the cost of $3.5 million. Today, more than half of this sand has eroded—the finer, imported sand erodes faster than the native, larger grained sand.



As I watched the waves, I realized that the question of preserving this beach was much more complicated than I had first thought. Won't the Critical Zone need to be nourished again soon? Is dredging or dumping sand to preserve the beach worth millions of dollars of tax money? What about the need to preserve this habitat for species like the piping plovers or the horseshoe crabs? How much of Sandy Hook's beaches should be closed off to summer visitors to protect rare species? What should be done about human-caused pollution, such as the storm sewer runoff from the Highlands, which is affecting the horseshoe crabs?

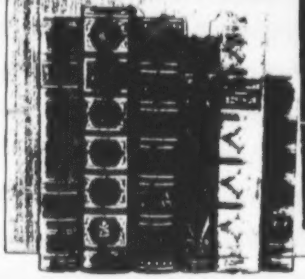
As a student, I could only ask these questions and hope to explore the answers later. ■



Original artwork by Madeline Kunsberg

Madeline Kunsberg, a homeschooler in New Jersey, is interested in writing, chemistry, international affairs and illustrative drawing. Her hobbies include teaching 4-year-olds to read, breeding fish, and rehabilitating neurotic parrots.

The Young Naturalist Awards is a program of the American Museum of Natural History.



Off The Shelf

Stranger in a Strange Land

Review by Monica Kolb

I read Robert Heinlein's *Stranger in a Strange Land* a few months ago because my friend recommended it as a good science fiction novel. Once I'd started, I couldn't believe I hadn't read it earlier. Written in 1961, it is a true classic of science fiction and a book I'll remember for a long time.

The novel focuses on Valentine Michael Smith, a young man who was born on Mars shortly before his parents died in a doomed exploratory mission to the Red Planet. Orphaned, he was raised by Martians, beings whose physical selves, ways of thought, and lifestyles are impossibly different from those of the human race. Some 20 years later, he is found by a second human mission to Mars and brought back to Earth.

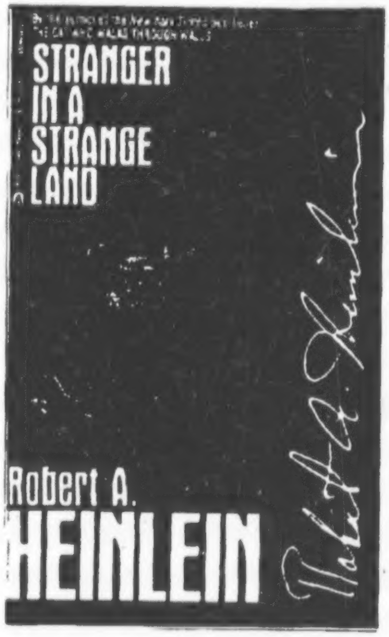
Once there, Smith is supposed to learn about humans so he can adapt to life among his own species. His first concern, though, is the strange experience of thick air, crushing gravity, and attempting to communicate with beings who speak a different language and think in different ways. Naive as he is, Smith is quick to learn. He has already grasped the basics of English when he is kidnapped out of the custody of Earth's main political body, the Federation, whose ship brought him to Earth.

His kidnapper is Gillian Boardman, whose journalist friend, Ben Caxton, realizes that the Federation might wrest Smith's inherited fortune from him before he even understands what property is. Smith ends up with a rich, eccentric friend of Ben's, Jubal Harshaw.

On Harshaw's island retreat, Smith adapts to Earth life, customs, and women with eerie speed. He also demonstrates abilities that the Martians have taught him, such as staying under water for long periods of time and (somewhat alarmingly for his friends) reducing his vital signs to almost nothing.

Earth does take getting used to. For instance, Smith has difficulty with his first experience with grass on this water-drenched planet; he does not understand how something alive could be meant to be walked on:

> *He let himself be encouraged to walk around—and found that he did enjoy it and the living creatures did not protest… this was their proper being—to be walked on. He resolved to enfold and praise it, an effort like that of a human trying to appreciate the merits of cannibalism—a custom which Smith found proper.*



He is bewildered by the abundance of plants and water on Earth; his first glimpse of the ocean is nearly overwhelming. Used to the harshness of Mars, he is amazed at the lushness of an Earth whose inhabitants tend to take it for granted. Smith's experiences continually remind us that our planet is a truly incredible place.

Just as he learns from the Earthlings, the Earthlings find they have a lot to learn from him, particularly about a Martian concept called "grokking," which means "to understand so thoroughly that the observer becomes a part of the observed—to merge, blend, intermarry, lose identity in group experience."

Once Smith has gotten a basic orientation, the most daunting human concept proves to be religion. On Mars, there is no religion as such, only deep tradition and great respect for the Old Ones, the spirits of discorporate Martians. These spirits take an active role in Martian life, overseeing their living brethren and making the important decisions. Martians do not trouble themselves with the question of life after death, as it is obvious that discorporate Martians are as alive as anyone else. Mars has no fiction or mythology; therefore, Smith cannot understand how different people can believe in different things. He does not understand God, except perhaps as a very powerful Old One. Nor does he understand why humans cannot communicate with their dead. Eventually, Smith stumbles toward his own understanding of the universe, an understanding neither Terran nor Martian.

Although written some 40 years ago, *Stranger in a Strange Land* remains an impressive book. The philosophies outlined in it seem so simple—and possible. It is an entertaining book for anyone who appreciates imaginative science fiction; it's also a thought-provoking look at how the world might be better if we could break away from traditional, selfish Terran thinking. ■

Monica Kolb **is a sophomore at Bishop Guertin High School in Nashua, NH. She performs in her school concert band, chorus, and color guard; she's also on the school math team. Her hobbies include hiking, writing, and computer programming.**

Word Wise

ROBOMANIA

by Carol Blackburn

ACROSS

1 Author of the Three Laws of Robotics

7 Sony's robotic dog

11 Blood count in the ER

14 Bahamian island

15 Kiln

16 Straw

17 Remotely controlled robots

18 Endure

19 Institutional review board (abbr.)

20 We (Ger.)

22 National Endowment for the Humanities (abbr.)

23 __ Magnon

24 Transducer that causes a robot to move

29 Wiring connecting robot to a controlling device

31 Kind of logic

32 Building (Ger.)

34 Toss

35 Saudi

36 Transform a program from source code to object code

38 Ready to run (abbr.)

39 Taiwan (abbr.)

40 Test

41 Joint

44 Picard's Borg name

46 U2 lead

47 Abandon a project

50 According to (Lat.)

51 Coined the word "robot"

52 Zip the Robot's home state

54 Ability of a robot to recognize and identify an object

56 Author of *The Cyberiad*

57 Table of contents

59 Progeny

60 God (Lat.)

61 Somali-born model

63 Fix

68 Home pregnancy test

69 Sympathize

70 Laura Wingfield's mother

71 Grain

72 Young scribe in *The Name of the Rose*

73 Robot designed to go into dangerous places

DOWN

1 Aboard (abbr.)

2 Knight's title

3 Offer an opinion, on the Internet

4 Max's opposite

5 Kind of street

6 __ *to a Small Planet*

7 Major ISP

8 __ the Terrible

9 Besiege

10 Real-time processing (3 wds.)

11 Mexican food chain owner

12 Inhospitable

13 Bionic human

21 Robotic soccer game

24 Distant

25 Brusque

26 Tyrant

27 Uzbekistan (abbr.)

28 Kind of memory

30 Target location error (abbr.)

33 Directs upward

36 Chain of command (abbr.)

37 Tax agency

39 Participants include Malvolio, Hamerschlag, Ram Force, and Evil Beaver

41 Shoshonean

42 Carlos Fuentes novel

43 Prod

44 Kind of nut

45 Ball holder

46 Night flier

47 Join metal surfaces

48 Unnerving

49 Control device

51 Theater

53 Antarctic-roaming robot

55 Jewish scripture

58 Spyder and Viper

62 *The Matrix* hero

64 Mexican Nobel Prize winner

65 American National Bank (abbr.)

66 Marriage vow (2 wds.)

67 Rodent

1	2	3	4	5	6	■	7	8	9	10	■	11	12	13
14						■	15				■	16		
17						■	18				■	19		
■	■	■	■	20		21	■	22			■	23		
24	25	26	27				28	■	29		30			
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■	■	■	44				45			■	46			
47	48	49			■	50			■	51				
52					53	■	54		55					
56			■	57		58	■	59			■	■	■	■
60			■	61			62	■	63		64	65	66	67
68			■	69				■	70					
71			■	72				■	73					

Solution on page 34

Science Journalism

Photo by Eileen Hohmuth-Lemonick

Interview with

Michael Lemonick

by Melissa Hartman

Michael Lemonick is the senior science writer at TIME magazine, where he has worked for 16 years. He is also the author of two books: *The Light at the Edge of the Universe* and *Other Worlds: The Search for Life in the Universe*. The latter earned him the American Institute of Physics Science Writing Award, and he has won two writing awards from the American Association for the Advancement of Science for stories appearing in TIME. Mr. Lemonick has also taught science writing at University of Wisconsin and Princeton University. In this interview, he explains how he found the perfect career—one he didn't even know existed when he was in college.

Have you always been interested in science?

For as long as I can remember, I've been fascinated with the stars and the galaxies and the universe. I always wanted to know about the most distant and mysterious objects in the universe. I loved reading popular science books about astronomy, but I would get bored by the long early chapters on what the Greeks and Romans thought. I was most excited by the last and shortest chapters—the ones about modern work in astronomy. That was where I really wanted to start. That's why I decided to major in astrophysics in college.

But you ended up with a degree in economics. What happened?

I was always interested in science, but at a conceptual level. I never enjoyed doing lab experiments, and math was something I could do, but I didn't take enormous pleasure in it.

In college, like all aspiring astrophysicists, I had to take the basic physics course first. I didn't enjoy the lectures dense with math or the labs where we would bounce things off other things and measure the rate at which they rebounded. I wanted to know what the universe is made of, but you just don't get to talk about things like that in an introductory physics course.

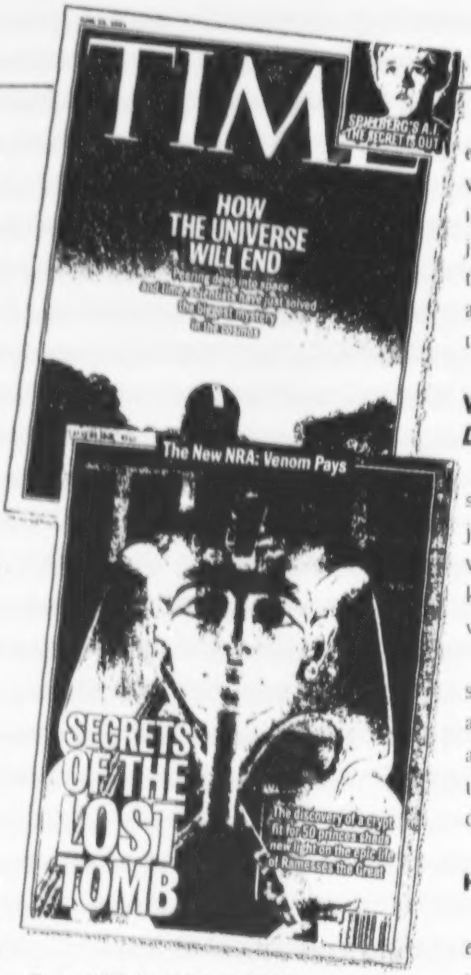
I knew by my second year that I wouldn't major in astrophysics, but I had no clue what I would major in. One thing that made it so difficult was that while my interests were in science, my talents were verbal and always had been. But what was I supposed to do with those talents, major in English literature? That didn't appeal to me either. When the time came to decide, I just chose economics, which sounded as good as anything else. It was a very confusing and disheartening time for me.

Did you at least take some enjoyable writing courses in college?

No. The only writing courses available were in creative writing, and I had no interest in writing fiction. There were no nonfiction writing courses, no journalism courses at the college I attended. Now, in retrospect, I wish I would have taken the creative writing courses because those tools could be very useful to me as a journalist.

When did journalism occur to you as a career choice?

About two or three years after I graduated from college. I had some pretty menial jobs after college and eventually took a job as a proofreader at a small publishing company. Now at least I was doing something that employed my talents, but it still wasn't satisfying. I longed for something more challenging and interesting.


TIME
SPIELBERG'S A.I. THE SECRET IS OUT
HOW THE UNIVERSE WILL END
Peering deep into space and time, scientists have just solved the biggest mystery in the cosmos
The New NRA: Venom Pays
SECRETS OF THE LOST TOMB
The discovery of a crypt fit for 50 princes sheds new light on the epic life of Ramesses the Great

Two of Michael Lemonick's 40+ cover stories

At about that time, in the late 1970s, a big change happened in the world of journalism: science journalism became much more visible. The *New York Times* first published its stand-alone science section, the Science Times, and I loved reading that. And about four popular science magazines were started around that time, including *Discover* and *Science Digest*. Now there was all this great stuff to read, and I realized that there was such a thing as science journalism.

Then, through a weird connection, I met one of the staff members at *Discover*, a young guy I played Frisbee with. I soon developed a powerful envy; he was learning about science at just the level I really enjoyed and was paid to explain what he'd learned. I knew that was what I wanted to do.

Is that why you decided to go to grad school in journalism?

Yes. When I realized that I wanted to be a science journalist, the only question was, how do I do it? This guy had gotten his job because he had a science degree. The editor at *Discover* believed that you can teach anybody to write, but you can't just give anybody a scientific background. So he hired scientists and taught them how to write.

But I didn't have a science degree, so I decided that my way into the field would be through journalism school. The problem was that I hadn't done that well in college. I hadn't gotten close to any professors, so I had no one to recommend me. I had no experience in journalism, not even with the college newspaper. I basically had nothing to show that they should take me. And they didn't.

When I got over that disappointment, I decided to take a night course in journalism at NYU. I made sure my professor knew me well, and I worked hard to write good stories that he would like. I also found a job at a local paper, mostly covering school board meetings but also writing occasional feature stories. Whenever possible, I wrote science-related features. Then, when I was ready to apply again, I had clips to include and recommendations from my editor and my journalism professor. And that time I was accepted.

I spent a year at Columbia studying science journalism, and from there, through connections with alumni and professors, I managed to get a job at *Science Digest*.

When you started writing about science, did it click for you that this was what you were supposed to be doing?

Immediately. When I wrote my very first feature for the newspaper on a science topic, I felt like I was at home. I was learning about science and explaining it to the readers of the paper, and it just felt completely right. And of course the biggest thrill was when it came out and I saw my name in print for the first time. It was incredibly exciting.

What work did you do at *Science Digest*?

I was hired as a copy editor, which is sort of a glorified proofreader. I took that job because it was a foot in the door. It was a place where people could get to know me, and, with any luck, if there was any promotion I would get it.

Three days after I took the job, they said, "We really need someone to write and edit stories more than we need another proofreader." That's how I came to write short items and edit the writing of freelancers. I did that for three years.

How did you end up at TIME?

I wanted to go to TIME because *Science Digest* wasn't widely read, and I wanted more exposure. I wanted the glamour—and the salary—that you get at a big magazine. Then, one day, I heard from a friend that TIME was looking for a science writer. About five seconds later, I was on the phone with the secretary of the science department at TIME, who told me to send my résumé and clips and that they would let me know. I wasn't encouraged by that, but then about three minutes later the phone rang. It was the science editor, who told me that he knew my work. He had been the founding editor of *Discover*, and part of his job was reading the competing magazines, like *Science Digest*. He was also very interested in physics and astronomy, the topics I wrote most about. He said he wanted to talk to me in person. I got the job, and *Science Digest* folded about a month later.

Continued on page 30

After you'd been at TIME for a few years, you left to be executive editor of *Discover*. Why did you make that move?

A friend of mine had become *Discover's* editor in chief, and he wanted me to work with him. At the same time, my editor at TIME wasn't letting me write about the kinds of things I enjoyed writing about; he wanted to publish more about policy and legislation, which just didn't appeal to me. So I made the move, but I quickly found that the job wasn't a good fit. I was responsible for working with designers, artists, and freelance writers, and wasn't doing nearly as much writing as I wanted to do. The salary was great, but I didn't enjoy managing the hundreds of little tasks and tying up all the loose ends that make a magazine run smoothly. I returned to TIME after eight months.

At TIME, you write about topics that aren't easily accessible to a lay audience. What are your tricks for writing about these topics?

I look for analogies that can help people understand concepts in more familiar terms. I also like to give people amazing facts, like that neutrinos just pass through the earth effortlessly and that millions of them pass through our own bodies every day. I try to give interesting background, like that neutrinos are formed by stars when they explode.

Most important, I write about the stories behind science. When possible, I write about the people involved in making the discoveries and doing the research. The human element is appealing to readers, which perhaps explains why so many science writers specialize in biology and medicine, things that affect people directly. It can be a little harder to show physics or astronomy as relevant to a reader. But if I can show how excited an individual astronomer feels about solving a major mystery about the universe, or how incredibly hard it is to measure the super-faint light from a distant star—and how hard it is to stay awake all night to do so—then I think the reader finds it easier to get excited, too.

What was the most challenging story you've worked on?

It was a story about particle physics. I wasn't writing about a discovery that made headlines; instead, the editor had decided we should do a story on a particle accelerator he'd recently visited and was deeply impressed by. There wasn't an obvious story to be told because nothing had happened; yet I had to make it clear that when you added it all up, the broad picture about what our universe is made of—what its smallest building blocks actually are—was becoming clear at last. I talked to as many people as I could about their work and how it fitted into the overall picture and eventually figured out a way to write a story about it. I guess it turned out okay: the story won an award from the American Association for the Advancement of Science.

Who decides what topics you'll cover in TIME?

The science department at TIME works cooperatively. The editor makes all the final decisions on a story, but only after we've discussed it as a group, talking about what approach to take, what stories to include in the magazine, and how long it should be. Usually, the writer who suggests a story will write it, but not always; we'll yield to our colleagues if they're more expert on a topic. Sometimes the ideas come from the editor, or even from his superiors; in that case, he decides who's got the most free time, who's the best informed, and who will do the best job on a particular story.

In addition to 40 cover stories, you've written two books. Why did you decide to write them?

Several reasons. First, a book is the biggest challenge a writer can take on, and I wanted to prove to myself that I could do it. Second, even a cover story in TIME is too short to go into a lot of detail, to flesh out the personalities of the scientists, to explain the science thoroughly, and to put recent discoveries in context of the history of a topic. A book let me do that. Both times, the projects were difficult and time-consuming enough that I had to take several months off from my duties at TIME—and a good thing, since a book requires a lot of mental energy and focus. Switching back and forth from weekly news articles to a book would have been very tough.

What advice would you offer to students who are interested in science writing?

It is useful to have a serious grounding in science, to have a science degree. If you're considering whether to major in science or in journalism, I'd say do the science. The guy who founded *Discover* was right—you can teach a scientist to be a good writer if the person has some talent. It's not as easy to teach a writer to appreciate and understand science.

I would also like to say that I feel very lucky, as someone who didn't fit into a traditional niche, to find that there was one for me after all. I think that should be encouraging for people who aren't on a narrow, predictable track to be a doctor or a scientist. There are ways to make your own track, to combine your interests in a way that works for you. ■

For more information about science journalism, see *cty.jhu.edu/imagine/links_95.htm*

lanning Ahead for College

Frequently Asked Questions

by Linda E. Brody, Ed.D.

In this column, we consider some questions high school students have sent us related to the college preparation and application process that have not been addressed in recent issues of *Imagine*.

Will colleges get my talent search scores? How often and when should I retake the SAT?

Only SATs taken in 9th grade or later are sent to colleges, so the admissions committees will not see your talent search scores. Presumably, later scores will be higher, however, if you scored extremely well in the talent search you may want to tell colleges about your early precocity.

Colleges view multiple scores in different ways. Some average them, while others choose the highest or most recent scores. In general, the spring of 11th grade is a good time to take the SAT for college admissions. Earlier may not give you your maximum score, and waiting until senior year gives you little time to retest if you don't do as well as you expect to.

How can I qualify for a National Merit Scholarship?

Scores on the PSAT are used for initial screening. Taking the PSAT in 10th grade is good practice for later PSAT and SAT test taking, but the 11th grade PSAT score is used for National Merit Scholarship eligibility if you are spending four years in high school. Requirements vary by state for semifinalist status; then, additional criteria are used for finalist status.

Finalists may be eligible for any of three types of awards: National Merit $2500 scholarships, corporate-sponsored scholarships, and college-sponsored scholarships. To be awarded a corporate scholarship, a family connection to the corporation is usually necessary; for a college award, you must plan to attend that college. For more information see www.nationalmerit.org

My school has few advanced courses. Will this hurt my chances for admission to a really good college?

College admissions officers consider available resources when evaluating the extent to which students take advantage of them. But we recommend that you seek out alternatives, such as summer programs, distance education, college courses, and independent study. If you prepare for them, you can take AP tests without having taken an official AP course. Colleges will be impressed with your initiative, and, more importantly, you will need the advanced work to compete in college with other students who have experienced academic rigor in high school.

Most of the colleges to which I am applying want three SAT-II achievement tests. Does it matter which ones I take?

Most students take English and math, along with one or more additional tests of their choice. Some colleges require English and/or math, but, if they don't specify, you are free to choose the tests you are likely to score highest on. Remember that these are achievement, not aptitude, tests that measure what you actually learned about a subject, so evaluate whether your high school coursework prepared you well for this exam. It's a good idea to study a bit in preparation, too. If you think you can do well on more than three tests, take them. These standardized tests demonstrate your knowledge compared to a national sample of college-bound students.

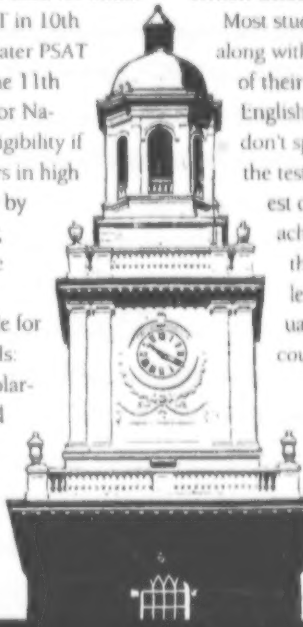
I don't have the money to attend an academic summer program. Will this hurt my college admissions chances?

First, you should be aware that there is a lot of scholarship money available for students with financial need to attend summer programs. CTY, for example, awards over $2 million in financial assistance each year to students who attend our summer programs.

However, attending a summer program is not critical. What is important is that you do something meaningful in relation to your own talents and goals for the future. If music is important to you, continuing your music lessons, practicing, and teaching young children as a community service may be appropriate ways to spend your summer. If you plan to go into medicine, you may want to volunteer in a hospital. Maybe you want to spend one summer reading all the books in the library you always wanted to read. If you want to take a class, a local college course may be less expensive than a residential program. Using summers well is important, but there are many excellent options.

I was suspended for a few days in 10th grade because of some trouble I got into and am concerned that colleges may hear about it. What should I do?

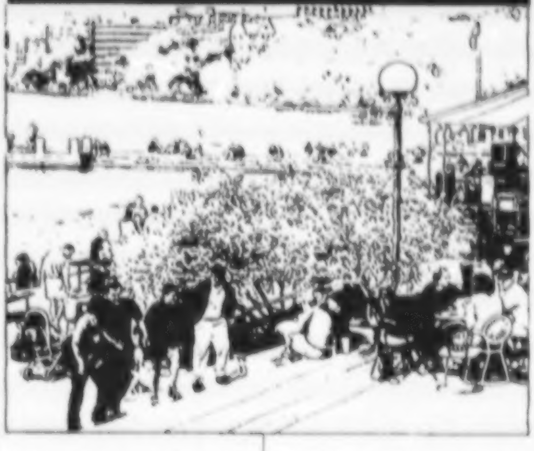
We recommend that you do not try to hide it. Rather, talk about it in a letter or an essay in a way that shows what you learned from the experience and how it actually had a positive impact on you and your subsequent behavior (hopefully it did!).



If you have questions you would like to see answered in this column, write to Melissa Hartman, CTY/Imagine, 2701 North Charles Street, Baltimore, MD 21218-9949, or send e-mail to mhartman@jhu.edu

UNIVERSITY OF WISCONSIN

The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.



Our reviewers include 18 individuals, who major(ed) in advertising & public relations (1), African studies (1), anthropology (1), biological aspects of conservation (1), chemical engineering (1), chemistry education (1), computer science (1), consumer affairs (1), creative writing (1), electrical engineering (2), environmental studies (1), French (1), international relations (1), math (1), medical microbiology & immunology (1), molecular biology (3), political science (2), special education (1), wildlife ecology (1), and zoology (2). (The number of majors exceeds 18 because several reviewers had double majors.) Reviewers' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Reviewers agreed that, with 133 departments and over 4,500 courses, the University of Wisconsin at Madison (UW or just "Madison") has a great deal to offer motivated undergraduates. An Honors Program provides smaller classes for UW's top students.

➤ "Madison is a top-notch institution, but with a comparatively relaxed atmosphere. I have taken classes from men and women who have achieved the highest honors in their fields, and research opportunities with world-class professionals abound in all disciplines. TAs are very approachable, as are most of the professors. Overall, UW can be as challenging as a student wants it to be."

➤ "UW has nearly 30,000 undergraduates, so intro courses have huge class sizes (100-500 students). Freshman year, I had little contact with my professors and I did the majority of my learning independently. As my education progressed, I found that professors are open and excited to help undergraduates. The size of UW then became an advantage, as scholastic opportunities were everywhere I looked. In my opinion, the quality of the education received at UW is up to the student. It is imperative to be active in learning, one of many valuable skills I learned there."

➤ "I really enjoyed my four years at Madison. For me, the lack of direct contact with professors during freshman year was not a problem. Freshman year is an ideal time to observe—to hunker down and do work, but bide your time and figure out what direction to head in before working hard to be a BMOC (or BWOC). Once you do decide what you want, Madison is sure to have it."

➤ "Being in the Honors program enabled me to have discussion sections run by professors rather than TAs and to work one-on-one with professors on independent research projects I designed. Taking the Honors Biology sequence meant that I had smaller lectures and a core group of students with whom I formed lasting friendships. I always found my professors excited and interested to talk with me on both class-related material and any outside interest I had. The Honors classes I took were some of the best in my college career."

➤ "Madison is an enormous institution and thus can be difficult to navigate...but only if you don't try. While it can sometimes be an intimidating place because of the sheer number of students, the flip side of that coin is the number of options available. I never had a professor who was unwilling to meet with me or help me with whatever I needed; in fact, most are pleased when students ask to talk to them. UW taught me a valuable life lesson in not being passive. If you ask for help, it's there; but if you don't ask for help, it won't come to you. No one will take you by the hand and show you how to graduate on time. (Some think this is why many UW students opt for a 5-year college plan.)"

Social Life

Reviewers all praised the quality of life at Madison. The city is built on an isthmus between two lakes, one of which borders the UW campus.

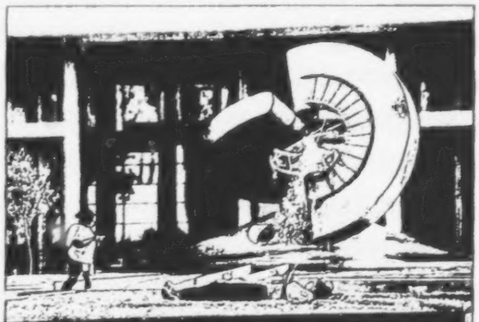
➤ "Fantastic. Madison is one of the best college towns in the nation. I recommend living in the lakeshore dorms for a couple of years, even if they aren't the most conveniently located housing. The dorms are a good way to meet people; I made some of my best friends there. UW-Madison also has one of the better co-op housing systems in the U.S. And learn to sail—you'll regret it later if you don't!"

➤ "The number of things one can do on any given day is incalculable. It's easy to find out what's going on if you make a habit of hanging out at the student union (easy to do). The union is a great place both to study and to avoid study. Set on Lake Mendota, it has an outdoor terrace that overlooks the lake, a games room, an arcade, a movie theater, and more. On Friday and Saturday nights, there's almost always a band playing there; and throughout the year, it offers mini-courses on activities from sailing to pottery."

➤ "Quality of life is one of the main draws of UW. It has friendly students, over 600 student organizations, a city full of activities, and a health-conscious environment. The Lakeshore Path and the Arboretum are always full of walkers, joggers, bikers, and rollerbladers (okay, maybe not in the dead of winter). Even if you're not a varsity athlete, you can find many opportunities to play your favorite sport or try a new one. The Hoofers Club offers outdoor activities ranging from camping and mountaineering to windsurfing and kayaking. And the food scene includes many healthy options. Vegetarians needn't look far for a good meal."

➤ "Madison has a fairly liberal climate and a strong sense of civic pride and responsibility; it's called the 'Berkeley of the Midwest.' (This is where *The Onion* got its start.) I can't even imagine spending the golden years from 17 to 21 anywhere else. I learned so much and met people from such different walks of life."

➤ "Madison is known as a party school, and with good reason. Bars, house parties, and an active Greek community give UW a lively party life. As a freshman, I found the Greek system a great way to meet people (especially at a school this size!). Those who drink are generally respectful of the decision of others not to drink, and students who don't want to party can always find things to do and people to do them with. The town caters to students, and the campus borders downtown Madison, so nightlife is never far away. Coffee shops, bars, restaurants, and flower vendors line the pedestrian-friendly State Street, which also has a theater and civic center, if you feel like catching a movie, play, or dance performance."



University of Wisconsin

Madison, WI 53706
(608) 262-3961

▽ 4-year coed public university

▽ Campus in Wisconsin's capitol city

▽ Full-time undergraduate enrollment 2001-02: ~13,650 men; ~14,800 women.

▽ Special features: 1,300-acre Arboretum and nature preserve; Elvehjem Museum of Art; and the Wisconsin Alumni Research Foundation, a pioneer in technology transfer.

What Do You Like Best about UW?

➤ "I enjoy the whole experience that Madison offers. I find the people to be incredibly nice, the faculty to be interested in students, and the surrounding community to be supportive of the university. I am getting a good education and a great life experience at the same time."

➤ "From the partying and craziness of freshman year to challenging research with world-renowned professors, I was able to create an undergraduate experience that included everything I wanted from college. My experiences at UW prepared me for a future in the real world and provided me with the ability to meet any challenge."

➤ "I loved the school spirit—the football games, basketball, homecoming. I also loved Madison, the city, which has much to offer in its own right. And I loved the good times at Memorial Union—studying, taking yoga, hanging out with friends, or just watching the sailboats go by."

What Do You Like Least about UW?

Most reviewers mentioned challenges created by Madison's abundance of opportunities.

➤ "Being overwhelmed by too many opportunities. It is impossible to do everything, and that makes it difficult to decide what to actually do. You can easily get over-extended or lose focus. I maintain that graduates of UW deserve higher praise than those from many other schools because of the wealth of distractions Madison offers."

➤ "Because UW is so big, it is hard to know about all the opportunities available."

➤ "Sometimes I feel like a number, and it can be difficult to wade through all of the bureaucracy. But I feel that having to learn the ropes has been good preparation for the real world."

➤ "Most undergraduates are more intent on having fun than on taking advantage of the many academic opportunities here."

Who Would Be Most Compatible with the Academic and Social Atmosphere at UW?

"A large school like Madison is most suitable for students with motivation and initiative. It is not a place where you can flourish by sitting back and waiting for things to come to you. Proactive students will be able not only to take advantage of existing resources, but to create their own unique opportunities as well."

➤ "Madison may have a reputation as a party school, but it should be regarded more for the incredible wealth of opportunities it offers. Here, students get a full, well-rounded undergraduate experience."

If You Had It to Do over Again, Would You Go to UW?

All reviewers enthusiastically said yes.

➤ "Yes. For me UW-Madison was a superb education at a very reasonable price. I cherish the memory of my college years. Overall, the instruction was excellent, and my life outside of classes was wonderful as well. I made many life-long friends. Madison is a wonderful city and I would definitely consider living there again someday."

➤ "Absolutely! My college search included many smaller schools; but the largest one (by far) turned out to be the best choice for me. It was the greatest 5.5 years of my life...so far. I plan to move back to Madison to live."

➤ "No question. I would choose it again and again and again. I didn't always feel this way. It took me a while to get into the groove of things, but once I did, I never looked back."

Note: The reviewers quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

Summer is a great time to pick up a book you wouldn't have time to read during the school year. For this issue, we asked our Readers Panel to share their top picks for summer reading. Take this list to your local bookstore, and then kick back for some excellent reading!

Jeremy Stoller: ***Searching For Bobby Fischer* by Fred Waitzkin**: A touching and probing look at the world of children's chess championships, and ultimately the relationship between a father and son. A must, even for someone who wouldn't know a pawn from a king; this book will make you love the characters, the game, and the author's writing. ***The Unbearable Lightness of Being* by Milan Kundera**: Kind of a romance novel, kind of a light existentialist work, it's funny, honest, thought-provoking, profound, and completely enjoyable. It breaks many of the rules of writing, but this is part of what makes it so great.

Kathleen Bachynski: ***Sophie's World* by Jostein Gaarder**: A tale so engrossing it's easy to forget how much philosophy is crammed into the book's pages. And how refreshing to find the brilliant ideas of thinkers from Plato to Kant transformed into plain, direct language! ***Surely You're Joking, Mr. Feynman!* by Richard Feynman**: This hilarious book ought to be stored nearby, because there's a high likelihood that it will be reread several times. A background in physics is unneccessary to enjoy the adventures of this Nobel-prize winning scientist. ***The Nazi Officer's Wife* by Edith Hahn Beer**: This frighteningly honest account proves that a Jewish woman could transform herself into a treasured citizen of the Third Reich: "a breeding Aryan housewife." Beer's gripping autobiography reveals the insanities of war, incredible twists of fortune, and amazing kindness of both friends and strangers that contributed to her survival.

Elspeth Iralu: ***Pilgrim at Tinker Creek* by Annie Dillard**: Dillard takes you through a year in the natural habitat near her home, not only describing natural history and animals, but also questioning how we do things and what we think. ***My Family and Other Animals* by Gerald Durrell**: Durrell writes of his growing up on an island off of Greece. His stories of his interest in animals and other aspects of his childhood are very entertaining to read. ***The Flame Trees of Thika* by Elspeth Huxley**: This memoir takes you back in time to colonial East Africa where the author's parents, entrepreneurial coffee growers, try to make a living. While her parents take care of their business, young Elspeth has her own adventures.

Shelby Yu: Any of Agatha Christie's books featuring Hercule Poirot. Christie's mysteries are incredibly well contrived, with a tint of humor added by the eccentric detective, Poirot. They are just how a perfect mystery should be—drawing the reader to solve the crime with Poirot and exclaim half indignantly, half appreciatingly at the conclusion, "It all makes perfect sense! Why didn't I realize it earlier? ... But how clever!" ***Einstein's Dreams* by Alan Lightman**: What I found most intriguing was how the book played upon our perceptions of time to shed light on humanity. These ideas left me a good deal to reflect on: how time rules our actions, how we want to live our lives, and how different it all could have been.

Patrick Mihelich: ***The Things They Carried* by Tim O'Brien**: An amazing piece of writing, this collection of short stories is a stirring and insightful testament of the Vietnam War. ***Slaughterhouse V* by Kurt Vonnegut, Jr.**: Based on Vonnegut's own survival of the fire-bombing of Dresden, this is a highly original and unorthodox novel that flirts with elements of science fiction. Plenty of food for thought. ***Watership Down* by Richard Adams**: A classic adventure story about a band of rabbits with very human problems. An entertaining read. ■

Crossword Solution:

A	S	I	M	O	V	■	A	I	B	O	■	C	B	C
B	I	M	I	N	I	■	O	V	E	N	■	H	A	Y
D	R	O	N	E	S	■	L	A	S	T	■	I	R	B
■	■	■	■	W	I	R	■	N	E	H	■	C	R	O
A	C	T	U	A	T	O	R	■	T	E	T	H	E	R
F	U	Z	Z	Y	■	B	A	U	■	F	L	I	N	G
A	R	A	B	■	C	O	M	P	I	L	E	■	■	■
R	T	R	■	R	O	C	■	T	R	Y	■	H	I	P
■	■	■	L	O	C	U	T	U	S	■	B	O	N	O
S	C	R	U	B	■	P	E	R	■	C	A	P	E	K
O	R	E	G	O	N	■	E	N	T	I	T	I	Z	E
L	E	M	■	T	O	C	■	S	O	N	■	■	■	■
D	E	O	■	I	M	A	N	■	R	E	P	A	I	R
E	P	T	■	C	A	R	E	■	A	M	A	N	D	A
R	Y	E	■	A	D	S	O	■	H	A	Z	B	O	T

Creative Minds Imagine

Until the Season's End

by Sara Schneider

Trembling petal,
Raise your face toward the sky
And understand
Why the moon sometimes cries
When it gazes into
The soul of the sun
And sees beauty so delicate
It comes undone.
Little flower,
Don't wilt in the torrent of tears
Of the souls who have struggled
For so many years.
Don't be crushed by the boots
Of those who have marched
From the ends of the earth,
Who are wearied and parched.
Brave stem,
Be not swayed by whispers in the wind.
Stay rooted and strong
Until the season's end.
Thrive on the simple beauty
Of the star-speckled night
And feed off of the sunsets
With their colors so bright.
Stare at it in wonder, flower,
For you're not meant to comprehend.
Shed just one tear for joy and sorrow
Before the season's end.

Mall Martyrs

by Sara Schneider

They march through the mall,
Faces set
In grim determination,
Spitting out twenties like ATMs,
Filling the bags that weigh them down
With miscellaneous clothing and junk.
"These are too heavy!" they complain,
So they stop to rest
And get something to eat.
One girl sees the empty eyes
Of the face of a starving child
Staring up at her
From the side of her milk carton.
She takes a swig,
And throws it out half-full.
"Who wants to look at that?" she wonders,
And they continue on their quest.
In a shoe store
Another girl dawdles over an array of expensive bo[illegible]
Black
In style
And most of all,
Brand name.
She fingers one pair hungrily,
Eyeing the price tag with contempt.
"I'd die for those shoes," she says aloud.
What a martyr.

Sara Schneider is in 10th grade at Westhill High School in Stamford, CT. She works as an editor on her school's newspaper and mentors children at a community center. She enjoys creative writing, painting, and watching people when they think no one's looking. Her passions range from macaroni and cheese to Albert Camus.

Show Your Creative Side

Creativity is what this page is all about. So send us your poems, your photographs, your stories. Send a creative essay, or slides of your paintings and sculptures.

We're always considering creative work for upcoming issues. Send yours to Melissa Hartman at mhartman@jhu.edu or CTY/Imagine, 2701 N. Charles Street, Baltimore, MD 21218-9949.

Knossos Games

by Tim Boester

Even if you don't have your Learner's Permit, you can still test your driving ingenuity on this puzzle.

The Goal: Go from Start to Finish passing through exactly **eight** intersections, no more, no less.

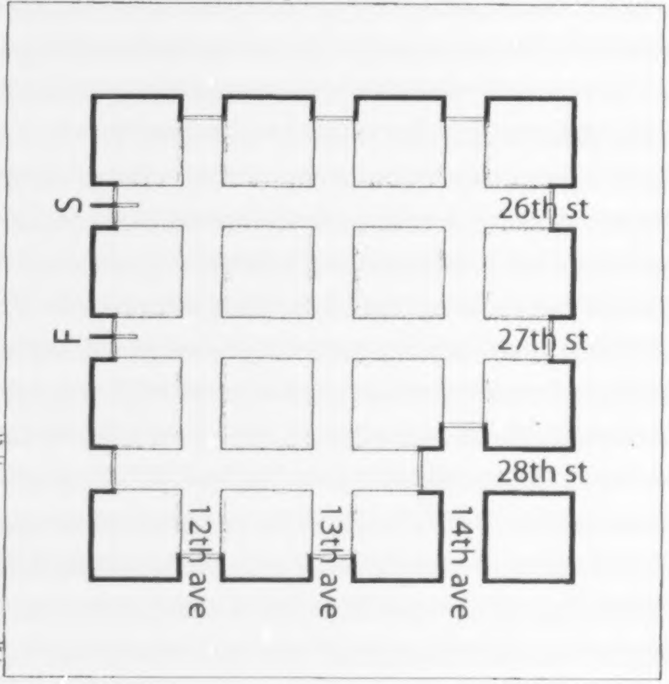
The Rules:

- Except when you start and finish, you must stay within the outlined area.
- All roads are two-way.
- U-turns are illegal.
- You must obey one of these two-part statements:

  (A) If you turn right at the second intersection, you must go straight at the sixth intersection. If you don't turn right at the second intersection, you must go straight at the fourth.

  (B) If you turn left at the third intersection, you must turn left at the eighth. If you don't turn left at the third intersection, you must go straight at the sixth.

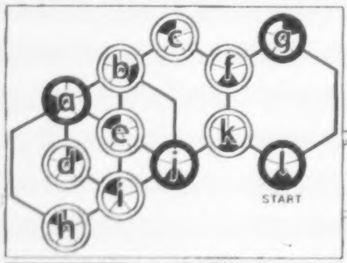
  (C) If you turn left at the fourth intersection, you must turn right at the sixth. If you don't turn left at the fourth intersection, you must turn left at the fifth.



Each two-part statement has a legal solution. See if you can find all three.

A graduate student in educational psychology at the University of Wisconsin, *Tim Boester* now has additional puzzles on his home page: http://homepage.mac.com/boester

Solution to Knossos Games in our March/April issue:



solution:
l-g-f-k-j-b-e-i-h-a-d-i-j-k-f-c

*What was your favorite Knossos Games puzzle? Visit Tim's Web site to review the many formats he has created, then e-mail him your favorite. For **Imagine**'s tenth anniversary, Tim will create a new puzzle like the one that receives the most votes.*

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EFF-089 (1/2003)